Hylebos Browns-Dash Point
Volume 1 - Basin Plan & SEIS
Volume 2 - Appendices

HYLEBOS BROWNS-DASH POINT
Volume 1 - Basin Plan & SEIS
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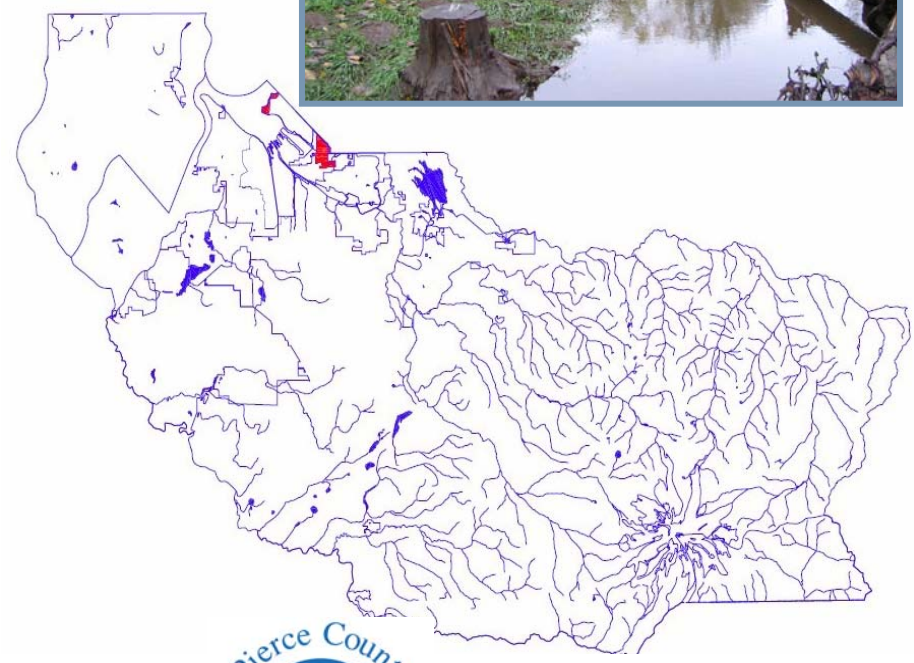
As Adopted PCC 2006-75
December 2006



Pierce County
Public Works & Utilities
Water Programs Division

Hylebos Browns-Dash Point Basin Plan

December 2006

Pierce County

Public Works & Utilities
Water Programs

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HYLEBOS BROWNS-DASH POINT BASIN PLAN
Executive Summary

ES.1 INTRODUCTION AND PURPOSE

The Hylebos Browns-Dash Point Basin Plan (Basin Plan) is intended to serve as a comprehensive guide to storm drainage and surface water management in the unincorporated parts of the Hylebos Creek and Browns-Dash Point drainage areas. The Basin Plan addresses many aspects of surface water management with emphasis on flooding, erosion, water quality, and habitat problems, by identifying problems and proposing solutions.

The purpose of the Basin Plan is to establish the actions that the Pierce County Public Works and Utilities, Water Programs Division will take over the next ten years to reduce flood hazards, protect water quality, and protect associated riparian and aquatic habitat in the Basin. Recommended actions are based on the physical characteristics of the Basin as well as:

- The laws, policies, and regulations that apply to storm drainage and surface water management in unincorporated Pierce County.
- The preferences of citizens in the County and in the Hylebos Browns-Dash Point Basin.
- The character of existing land use and planned growth as set out in the *Comprehensive Plan for Pierce County, Washington.*

The Basin Plan will guide annually updated work plans for capital improvement projects and programmatic measures of Water Programs ("Programmatic" refers to non-structural actions, such as changes to regulations, policies, programs, and how they are administered). The Basin Plan also identifies key supportive actions needed from other parts of county government and other jurisdictions to ensure that flooding, habitat, and water quality issues in this Basin are addressed in a coordinated manner.

Water Programs managers will convey these needs to appropriate programs (e.g., Transportation Division, Planning and Land Services Department, Tacoma-Pierce County Health Department, Pierce Conservation District, community planning boards and forums, neighboring jurisdictions and Washington State Department of Transportation).

This Basin Plan has been developed as part of Water Program's basin planning program. The program updates the *Pierce County Storm Drainage and Surface Water Management Plan* (1991 Plan) by developing basin-specific plans. The 1991 Plan has guided storm drainage and surface water management facilities and services for over a decade and much of the 1991 Plan has been implemented. The 1991 Plan studied the Hylebos Browns-Dash Point Basins and recommended capital improvement projects, some of which have been constructed. The Hylebos and Browns-Dash Point are two of 26 Pierce County drainage basins (see *Figure 1-1*).

The Basin Plan supports or furthers Pierce County's:

- Compliance with its federal *Clean Water Act* National Pollution Discharge Elimination System (NPDES) municipal stormwater permit.
- Compliance with the *Endangered Species Act* (ESA) by eliminating or reducing existing or potential habitat issues that could cause "jeopardy" for protected species.
- Upgrade to a "Class 4," rating or better under the Federal Emergency Management Agency's (FEMA) *Community Rating System* (CRS).

ES.2 GOALS OF THE HYLEBOS BROWNS-DASH POINT BASIN PLAN

Specific goals and objectives of the Hylebos Browns-Dash Point Basin Plan are as follows:

Reduce Flood Hazards

- Reduce the number of incidents of property loss and repeat damage.
- Avoid adverse impacts of flood events to streams.
- Improve Pierce County's standing under the Federal Emergency Management Agency's "Community Rating System."
- Locate new development outside of flood prone areas.

Improve Fish and Wildlife Habitat

- Increase the number of stream miles available for wild, native fish populations.
- Maintain or increase population numbers of species listed as endangered or threatened under the federal ESA.
- Improve the quality and quantity of available wetland, riparian, and upland habitat.

Improve Water Quality

- Meet or exceed Washington's *Surface Water Quality Standards* (WAC 173-201a).
- Reduce the number of impaired water bodies on the 303(d) list. *Section 303(d)* of the federal *Clean Water Act* requires states to develop a list of polluted water bodies every two years.
- Maintain compliance with the terms and commitments in Pierce County's NPDES permit for stormwater discharge.
- Reduce the risk of groundwater contamination.
- Reduce rates of erosion.

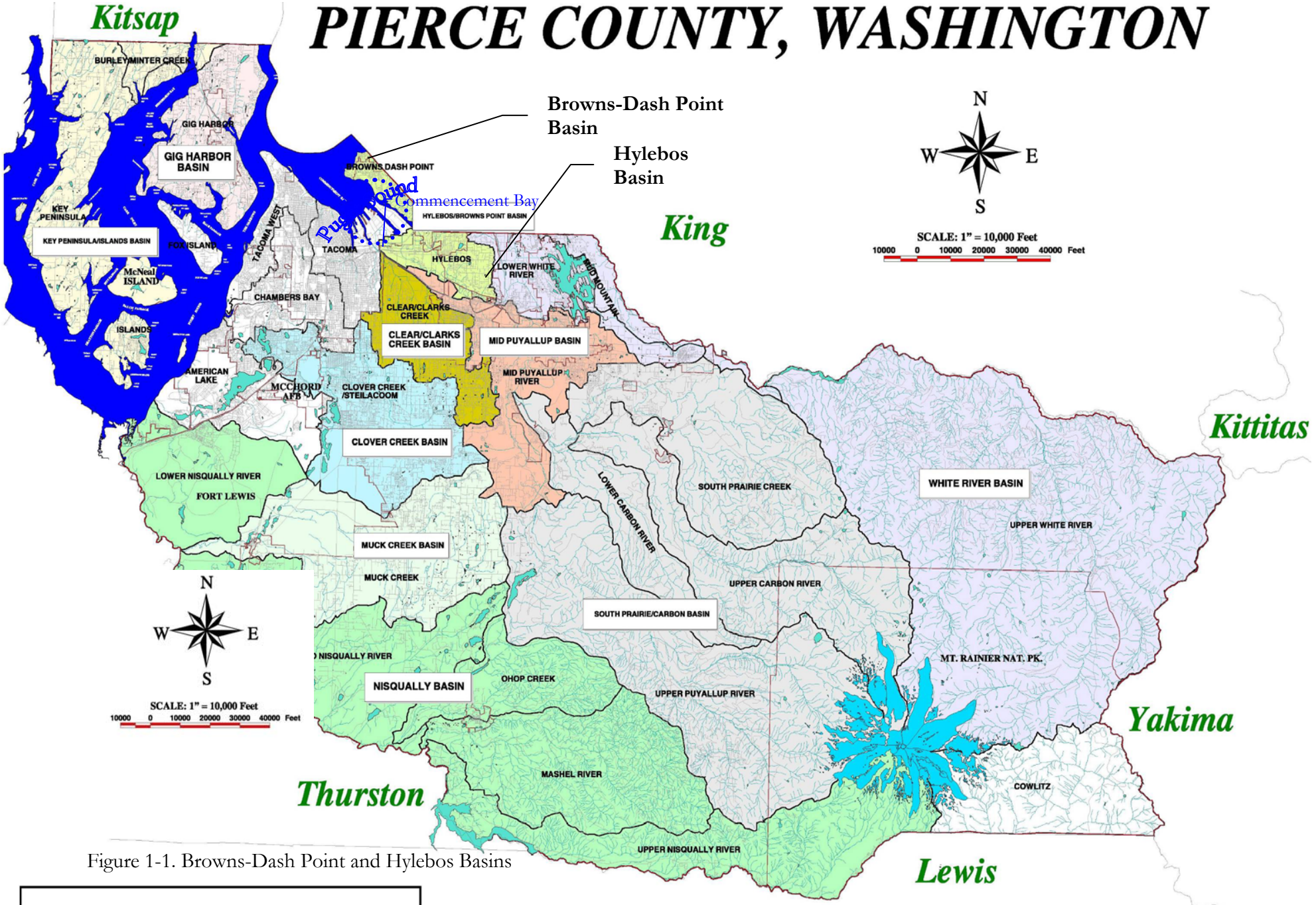

Figure 1-1. Browns-Dash Point and Hylebos Basins

Pierce County
Water Programs: Geographic Information Services

CARTOGRAPHER: D. GRINSTEAD
/HOME/UTLW/DGRINST/DW_BASINS.APR

Coordinated and Responsible Use of Public Resources

- Reduce the cost of maintaining stormwater facilities.
- Ensure favorable project value when benefits are measured against costs.
- Increase public awareness of flooding, habitat, and water quality issues.
- Ensure that monitoring and enforcement programs demonstrate an increase in services per dollar spent.
- Elements of other Pierce County plans are implemented in basin plan.
- Basin Plan findings are used by other agencies and jurisdictions in planning their activities

Influence Location and Methods for New Development

- Prohibit new development in flood prone, riparian, or significant habitat.
- Foster the use of low impact development techniques.
- Ensure the wide use of effective best management practices.

ES.3 BASIN DESCRIPTION

The Browns-Dash Point Basin and Hylebos Basin are both located in the northeast corner of Pierce County and are within the Puyallup Water Resource Inventory Area (WRIA) 10. The Hylebos Basin covers 29 square miles (sq. mi.) (18,625 acres), and the Browns-Dash Point Basin covers 15 sq. mi. (9,589 acres). Both basins straddle the Pierce/King County boundary. (See *Figures 1-2a and 1-2b*.) Because of incorporations by the cities of Tacoma, Fife and Edgewood there is relatively little area of each basin that is unincorporated Pierce County. Within the Browns-Dash Point Basin, 758 acres (7.9 percent of the basin area) are in unincorporated Pierce County. Within the Hylebos Basin, 950 acres (5.1 percent of the basin area) are located in unincorporated Pierce County.

The Hylebos Browns-Dash Point Basin contains Hylebos Creek and its tributaries and a "peninsula-like" feature northeast of the City of Tacoma with several smaller drainages that discharge directly to Puget Sound.

Browns-Dash Point Basin Area: Flows into Puget Sound

Hylebos Creek Basin:
East Fork
West Fork
Surprise Lake tributary
Lower Hylebos Creek

ES.4 Problems, Proposed Solutions and the Prioritization Process

Problems identified in the Basin Plan include: flooding of property and roads, impaired water quality, erosion and sedimentation, loss of floodplain, and degraded aquatic habitat. The Basin Plan addresses the adverse effects of these problems and issues such as: property damage from flooding; violations of federal, state, and local regulations; and threats to public health and safety. It explores the causes behind the problems.

Solutions for the problems are proposed in the form of Capital Improvement Projects (CIPs) and programmatic recommendations. Studies have been proposed to obtain additional information for some problems. Findings from the studies may result in future proposals of additional projects.

Each potential CIP and programmatic recommendation was evaluated for its net natural resource management benefits and then prioritized based on cost-to-benefit considerations. CIPs include projects that involve construction activity, land acquisition and restoration activities.

Programmatic recommendations are non-structural means of achieving program goals. County-wide programmatic recommendations include programs for development and implementation of an education, outreach and technical assistance program, development and implementation of a surface water monitoring program, development and implementation of an invasive species management program and development and implementation of a BMP Manual for Pierce County Surface Water Utility maintenance activities.

In determining net benefit, each project and program was scored using a system that assigned points for the project or program's potential for various aspects of flood reduction, water quality protection or improvement, natural resource improvement, and other factors such as economic development, multiple use, education, and recreation. Each project and program was reviewed and scored using approximately 40 specific criteria.

Recommended CIPs and programs were then put in rank order, based on their numeric benefit score, and grouped by "High," "Medium," and "Low" priority order. In total, the Basin Plan recommends $3,491,900 of projects, programs, and studies for the Hylebos Browns-Dash Point Basin. This includes $791,700 of "High Priority" recommendations; $2,141,900 of "Medium Priority" recommendations; and $548,300 of "Low Priority" recommendations. $10,000 of studies are also recommended to fill information gaps.

ES.4.1 Recommended Actions

The Hylebos Browns-Dash Point Plan contains 11 capital improvement projects, 14 programmatic measures, and one study to remedy flooding, erosion, water quality, and stream habitat problems resulting from surface water runoff in the Basin.

Table ES-1
Estimated Costs of Plan Recommendations

Project Type	High Priority	Medium-Priority	Low-Priority
Capital Improvement Projects	$510,300	$2,136,900	$548,300
Programmatic Measures(1)	$281,400	$5,000	NA
Studies	$10,000		
Total Estimated Cost	**$3,491,900**		

(1) Includes only the four programmatic measures developed specifically as part of the Basin Plan. County-wide programmatic measures implementation costs have not been estimated for the Browns-Dash Point or Hylebos Basins. See *Section 7.4*

Capital Improvement Project Recommendations

Table ES-2 on the following page summarizes proposed projects. Individual project descriptions are in *Chapter Seven*, Basin Plan.

Table ES-2
Recommendations Summary

Project Number	Project Name	Rating Score	Priority	Cost Estimate
PRG01-02	Check for Cross-Connections when Constructing New Drainage Projects in Browns-Dash Point Basin	226	High	$6,400
PRG01-03	Illicit Discharge Detection Pilot	241	High	$125,000
PRG04-01	Regional Coordination	244	High	$150,000
CIP04-LH1-RST01	Hylebos Creek Restoration	321	High	$510,300
			Subtotal	**$791,700**
PRG01-01	Coordinate with Tacoma-Pierce County Health Department to Prioritize Septic System Inspections	180	Medium	$5,000
CIP01-BDP6-CP01	Wa-Tau-Ga Avenue Cul-de-Sac - Storm Drain Replacement	181	Medium	$94,000
CIP01-BDP1-CP01	Spring Street NE - Install Drainage Pipe to Reduce Erosion	211	Medium	$103,800
CIP01-BDP6-OUT01	Catch Basin at Tok-A-Lou Avenue	186	Medium	$271,600
CIP04-LH1-CP01	66th Avenue and 8th St - Storm Drain Replacement	171	Medium	$387,600
CIP04-WH1-CP02	66th Avenue near 1st Street Ct - New Storm Drain	202	Medium	$536,200
CIP01-BDP4-CP01	Dry Gulch and Varco Rd - Increase Storm Drain Capacity	215	Medium	$743,700
			Subtotal	**$2,141,900**
CIP01-BDP6-CP02	Layman Terrace - Culvert and Storm Drain Replacement	80	Low	$35,300
CIP01-BDP6-MNT01	Tok-A-Lou Avenue near Ton-A-Wan-Da Avenue - Replace outfall	126	Low	$48,800
CIP01-BDP8-CP01	Northwood Avenue NE - Trash Racks for System Maintenance	82	Low	$71,600
CIP01-BDP5-CP01	Hyada Blvd at Wan-I-Da Ave. and La Hal Da Ave NE – Replace culvert and pipe	164	Low	$392,600
			Subtotal	**$548,300**
ST04-00-RST01	Hylebos Creek Restoration Opportunities	(1)	(1)	$10,000
			Subtotal	**$10,000**
PRG00-01 through PRG00-10	County-wide Programmatic Recommendations	(2)	Medium to High	(3)
Total Estimated Cost of Plan Implementation				**$3,491,900**

(1) Studies are not prioritized because they do not directly have the ability to address the factors that are evaluated.

(2) County-wide programmatic measures 1-10 have not been prioritized specific to the Browns-Dash Point or Hylebos Basins. See *Section 7.2.3*.

(3) County-wide programmatic measures 1-10 implementation costs have not been estimated for the Browns-Dash Point or Hylebos Basins. See *Section 7.2.3*.

ES.4.2 Implementation Strategy

Implementation of the recommended actions will generally follow the prioritization groupings of high, medium, and low and a logical order of sequencing.

To ensure the full benefits of all projects are realized, implementation will not follow the exact sequence of the first project to the last project in the High category, followed by the first action in the Medium category, and so forth. Several factors exist that will result in implementation of actions that are not in the exact sequence as depicted in *Table ES-2*.

These factors include the following:

- Availability of funds;
- The completion of other projects or activities on which a project relies;
- Available staff and professional services;
- Cooperation from private landowners;
- Identification of a implementing agency other than Pierce County Public Works and Utilities; and
- New information, regulations, or emerging issues.

Economic Development Criteria

Implementing projects and programs recommended in the Basin Plan is expected to reduce flood hazards, and preserve or protect water quality and floodplain habitat. Collectively and individually, these projects are aimed at protecting Pierce County's quality of life.

Projects and programs in the Basin Plan will:

- Afford resource protection as the community develops
- Preserve, enhance or protect natural floodplain functions
- Balance structural and nonstructural approaches
- Reduce potential County environmental liabilities
- Help achieve environmental compliance and long term sustainability

Collectively, these attributes help make Pierce County a livable community where quality of life issues will provide indirect, passive economic development benefits to businesses and individuals looking to locate or stay in Pierce County.

In addition, Water Programs will consider the following criteria in developing its annual proposed capital facilities plan updates:

- Is the project located in an employment center zone (or handle flow from those zones)?
- Is the project located in another type of commercial zone (or handle flow from those zones)?
- Will the project reduce permitting timelines for industrial/commercial projects?
- Will the project assure access to an employment center via road and /or rail?
- Will the project increase the supply of developable property?
- Will the project reduce overall development costs?
- Are there partners willing to contribute to the development costs of the project?
- Does the project allow / provide for land development?

In light of these and other factors, following action on the Basin Plan, Pierce County will develop an implementation strategy designed to sequence, schedule, and assign resources for the various recommended actions. This implementation strategy will be developed in collaboration and coordination with other potential implementers and in consideration of available financial and staff resources. The implementation strategy will include performance measurements and provide for periodic evaluation of progress.

CHAPTER ONE
Introduction

Pierce County Public Works and Utilities - Water Programs Division (Water Programs) is responsible for surface water management in unincorporated Pierce County (County). In carrying out this responsibility, Water Programs plans, designs, secures permits for, builds, and maintains storm drainage and surface water management facilities. Water Programs also identifies non-structural solutions to surface water problems such as monitoring needs, enforcement, regulatory changes, or services. Related responsibilities include compliance with the stormwater quality requirements of the federal *Clean Water Act*, the County's Stormwater *National Pollution Discharge Elimination System* (NPDES) *Permit*, and the habitat protection requirements of the federal *Endangered Species Act* (ESA). Other related responsibilities consist of river levee maintenance, stream gauging, water quality monitoring, gathering of rainfall data, emergency response during floods, water supply planning and public information. Fees paid by property owners in unincorporated Pierce County and grant funds pay for these facilities and services.

1.1 BASIN PLANNING PROGRAM

Pierce County Water Programs is preparing a series of basin plans to identify and prioritize projects and other Water Programs activities in individual drainage basins. Basin plans comprehensively address flooding, water quality and habitat aspects of surface water management in the major stream systems of the non-federal lands within Pierce County. The basin plans will update the county-wide *Pierce County Storm Drainage and Surface Water Management Plan* (Montgomery Engineers Inc., 1991)(1991 Plan) by identifying and addressing the flooding, water quality and stream habitat problems in a particular drainage basin in more detail than was possible in 1991. They incorporate the requirements of major federal, State and Pierce County laws, regulations and policies enacted since the 1991 Plan, such as the State *Growth Management Act* (GMA), NPDES requirements of the federal *Clean Water Act* (CWA), and the fish listings under the federal *Endangered Species Act* (ESA). The basin plans will be implemented primarily through Water Programs activities.

Figure 1-1 shows the location of the Hylebos Browns-Dash Point plan relative to the other drainage basins in Pierce County. Basin plans have been completed or are underway for all drainage basins in the County.

Basin plans identify existing conditions that affect storm drainage and surface water, forecast future drainage conditions, identify potential solutions, and evaluate alternatives to the degree that they achieve objectives or create probable significant environmental impacts.

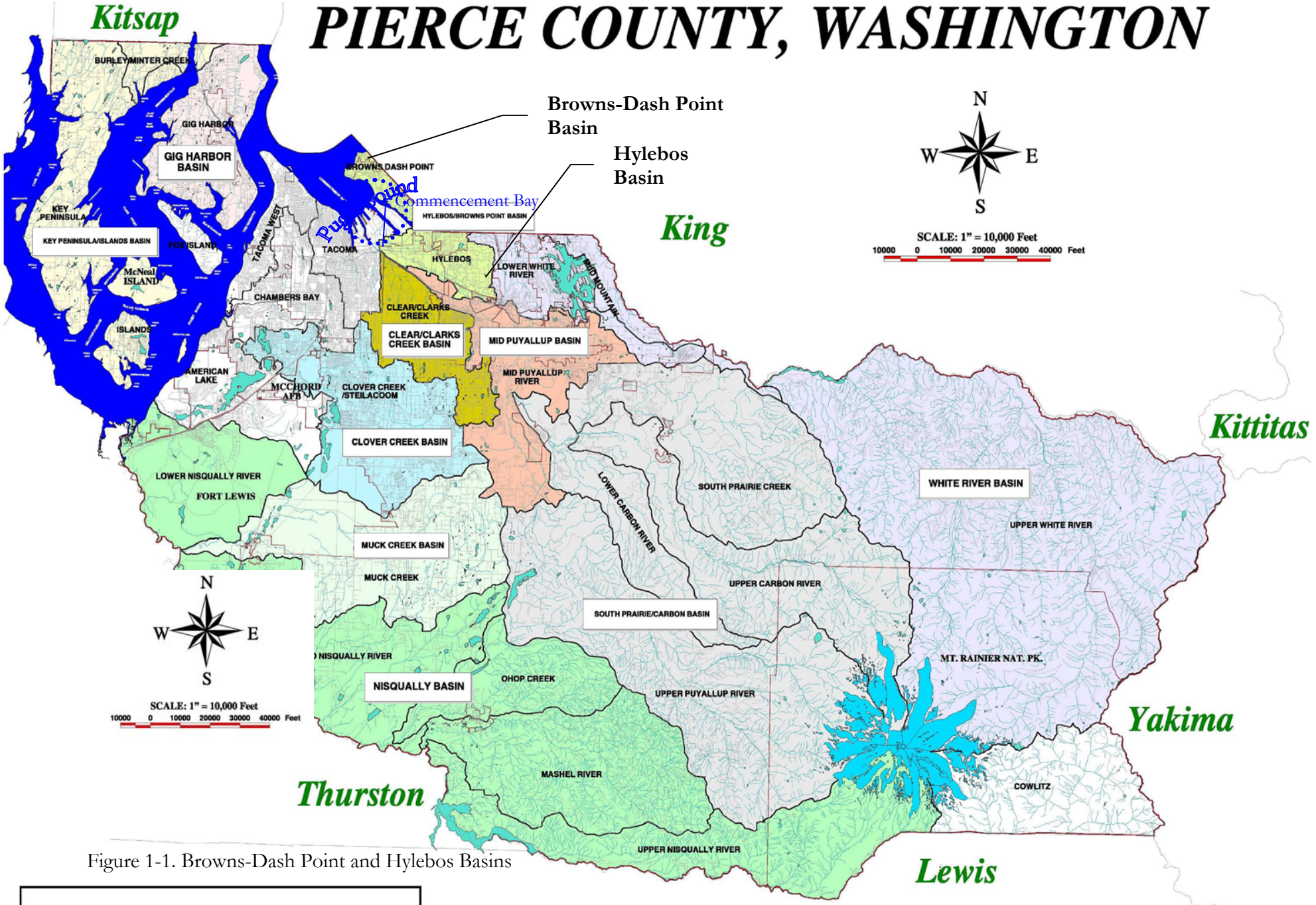

Figure 1-1. Browns-Dash Point and Hylebos Basins

Pierce County
Water Programs: Geographic Information Services

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The basin plans concentrate on remedies for frequently flooded areas, water quality problems, fish and wildlife habitat protection, and other surface water management concerns in the unincorporated parts of Pierce County. Drainage facilities within cities and towns, national forests, parks, and military bases are not within the scope of basin plans unless they affect drainage conditions in unincorporated areas. Basin plans are used to develop capital improvement, maintenance and repair, property acquisition, and program schedules and budgets. The planning process is divided into three phases:

Phase 1 is the basin characterization phase. It consists of inventorying and documenting existing conditions such as: flooding, water quality and habitat problems; existing storm drainage and surface water management facilities; regulatory environment; existing and future land use; stream flow characteristics; stream reaches and associated wetlands; other critical areas; the creek's ability to support various fish species; and the fish species present.

Phase 2 is the plan development and adoption phase. It builds on the findings of "Phase 1" by: correcting information; performing hydrologic and hydraulic analyses based on planned future conditions; filling information gaps; investigating problems; and identifying and recommending solutions. This document is the culmination of "Phase 2."

Phase 3 is the implementation, monitoring and plan update phase.

1.2 HYLEBOS BROWNS-DASH POINT BASIN PLAN

This Basin Plan presents surface water management recommendations developed for the unincorporated Pierce County portions of the Hylebos and Browns-Dash Point basins ("study area"). The Plan was developed by a planning team that consisted of Pierce County Water Programs staff and consultants. The Plan addresses many aspects of surface water management with emphasis on flooding, erosion, water quality and habitat problems and proposes solutions to identified problems. The actions recommended in this Plan are intended to reduce flood hazards and to protect water quality and fish and wildlife habitat in the planning area.

1.2.1 Study Area

The Browns-Dash Point Basin and Hylebos Basin are both located generally northeast of the city of Tacoma, and are within the Puyallup *Water Resource Inventory Area* (WRIA 10). The Hylebos Basin covers 29 square miles (18,625 acres), and the Browns-Dash Point Basin covers 15 square miles (9,589 acres). Both basins straddle the Pierce/King County boundary (See *Figures 1-2a* and *1-2b*). Because of incorporations by the cities of Tacoma, Fife and Edgewood, there is relatively little area of each basin that lies within unincorporated Pierce County. Within the Browns-Dash Point Basin, 758 acres (7.9 percent of the basin area) are in unincorporated Pierce County. Within the Hylebos Basin, 950 acres (5.1 percent of the basin area) are located in unincorporated Pierce County.

1.3 STATEMENT OF PURPOSE

The purpose of the Hylebos Browns-Dash Point Basin Plan is to determine what is needed and to establish actions Pierce County will take to reduce flood hazards and other storm drainage problems, protect water quality, and protect fish and wildlife habitat in the Plan area. Recommended actions reflect the physical characteristics of the basins: the laws, policies and regulations that apply to surface water management in Pierce County; the preferences of citizens in the County and in the Hylebos Browns-Dash Point Basin; and the character of existing land use and planned growth as set out in the *Comprehensive Plan for Pierce County, Washington* (Pierce County, 1995).

1.4 BASIN PLANNING PROGRAM GOALS AND OBJECTIVES

When the basin planning program was established, Water Programs staff defined a common set of goals and objectives for all basin plans. "Goals" refer to the desired outcomes of implementing each plan, and "Objectives" describe measurable indicators that the goals are being achieved. In addition to the shared goals and objectives of all plans, basin-specific goals and objectives may be developed in conjunction with basin stakeholders if appropriate.

The goals and objectives developed by Pierce County Water Programs for the basin planning program are listed below.

1.4.1 Reduce Flood Hazards

- Reduce the number of incidents of property loss and repeat damage.
- Avoid adverse impacts of flood events to streams.
- Improve Pierce County's standing under the Federal Emergency Management Agency's *Community Rating System*.
- Locate new development outside of flood prone areas.

1.4.2 Improve Fish and Wildlife Habitat

- Increase the number of stream miles available for wild, native fish populations.
- Maintain or increase population numbers of species listed as endangered or threatened under the federal ESA.
- Improve the quality and quantity of available wetland, riparian, and upland habitat.

Browns-Dash Point Basin

Figure 1-2a. Browns-Dash Point Study Area

Legend

- Browns-Dash Point Basin
- Study Area
- Watercourses
- Waterbodies
- Tidal Flat
- County Line
- Streets
- City Limits
- Proposed for Annexation

Data Source: Pierce County GIS, King County GIS

Commencement Bay

BIRCH ST NE
SW Dash Point Rd
SW 320th St
SW 322nd St
ALLEY
EAST SIDE DR NE
21ST AV NE
AGNES RD NE
BEVERLY AV NE
BROADVIEW AV NE
PARKVIEW DR NE
NORPOINT WY NE
50th PL SW
HYADA BLVD NE
ALLEY
WAUTAUGA AV NE
CALEDONIA RD NE
VARCO RD NE
RIDGE DR NE
ORCA DR NE
51ST ST NE
52ND PL NE
49TH ST NE
BROWNS POINT BLVD
NORTHSHORE PKWY NE
NASSAU AV NE
36TH AV NE
45TH ST NE
SR 509
NORTH SHORE BLVD NE
35TH ST NE
SW 349th Pl
KING COUNTY
PIERCE COUNTY
33RD ST NE
32ND ST NE
TACOMA
37TH AV NE
57TH AV NE
31ST ST NE
MCMURRAY RD NE
MARINE VIEW DR
29TH ST NE
53RD AV NE
54TH AV NE
58TH AV NE
61ST AV NE
26TH ST NE
25TH ST NE
E 11TH ST
NORPOINT WY NE
63RD AV NE
65TH AV NE
18TH ST NE
12TH ST NE
58TH AV NE

N

0 0.25 0.5
Miles

BROWN AND CALDWELL

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Hylebos Creek Basin

Figure 1-2b. Hylebos Basin Study Area

N

0 0.25 0.5

Miles

S 310th St
S 312th St
S 313th St
S 314th St
S 315th St
S 316th St
S 317th St
S 320th St
S 322nd St
S 327th St
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11th St S
1st Pl S
3rd Pl S
3rd Pl SW
4th Ave S
4th Ave SW
5th Ave S
5th Ave SW
6th Ave S
6th Ave SW
7th Pl S
7th Ave SW
8th Ave S
8th Ave SW
9th Ave S
9th Ave SW
9th Pl SW
10th Ave SW
10th Ct SW
12th Ave SW
14th Ave SW
16th Ave S
18th Pl S
19th Ave S
20th Ave S
22nd Ave S
24th Ave S
25th Ave S
25th Pl S
26th Ave S
26th Dr S
27th Ave S
28th Ave S
29th Ave S
30th Ave S
30th Ave S
32nd Ave S
33rd Ave S
33rd Pl S
34th Ave S
37th Ave S
38th Ave S
39th Ave S
Oakland Hills Blvd
Milton Rd S
Enchanted Pkwy S
Pacific Hwy S
Military Rd S
Kits Corner Rd S
1st Ave S
1st Ave SW
2nd Ave SW
3rd Ave SW
5th Ave SW
SR 18
SR 161
SR 99
5
KING COUNTY
PIERCE COUNTY
KING COUNTY
PIERCE COUNTY
TACOMA
18TH ST NE
10TH ST NE
58TH AV NE
62ND AV NE
1ST STCT NE
2ND STCT E
4TH ST E
8TH ST E
12TH ST E
15TH ST E
16TH ST E
18TH ST E
20TH ST E
TAYLOR WY
PACIFIC HWY E
MARTI CO RD
ALLEY
46TH AV E
47TH AV E
54TH AV E
58TH AV E
62ND AV E
66TH AV E
68TH AV E
FIFE
23RD ST E
24TH ST E
28TH ST E
29TH ST E
HARRY SMITH RD
VALLEY AV E
70TH AV E
76TH AV E
MILTON
JUNIPER ST
COMET ST
BIRCH ST
BIRCH CT
EMERALD ST
FIR ST
MILTON WY
TAYLOR ST
TAYLOR ST E
VINE ST
XAVIER ST
FIFE WY
2ND ST E
8TH ST E
13TH STCT E
18TH STCT E
Alder St
EDGEWOOD
87TH AV E
87TH AVCT E
90TH AV E
91ST AV E
92ND AV E
94TH AV E
95TH AVCT E
Legend
Hylebos Creek Basin
Study Area
Watercourses
Waterbodies
Incorporated Pierce County and King County
Proposed for Annexation
County Line
Streets
Data Source: Pierce County GIS, King County GIS
BROWN AND CALDWELL
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1.4.3 Improve Water Quality

- Meet or exceed *Washington's Surface Water Quality Standards* (*WAC 173-201a*).
- Reduce the number of impaired (*Section 303(d)-listed*) water bodies. *Section 303(d)* of the federal *Clean Water Act* requires states to develop a list of polluted water bodies every two years.
- Maintain compliance with the terms and commitments in Pierce County's NPDES permit for stormwater discharge.
- Reduce the risk of groundwater contamination.
- Reduce rates of erosion.

1.4.4 Coordinated and Responsible Use of Public Resources

- Reduce the cost of maintaining stormwater facilities.
- Ensure favorable project value when benefits are measured against costs.
- Increase public awareness of flooding, habitat, and water quality issues.
- Ensure that monitoring and enforcement programs demonstrate an increase in services per dollar spent.
- Implement elements of other Pierce County plans in the basin plan.
- Basin Plan findings are used by other agencies and jurisdictions in planning their activities.

1.4.5 Influence Location and Methods for New Development

- Prohibit new development in flood prone, riparian, or significant habitat.
- Foster the use of low impact development techniques.
- Ensure the wide use of effective *Best Management Practices*.

The above goals and objectives form the basis of the evaluation criteria to prioritize and select recommended facilities, policies, and programs from among the various alternatives considered during the basin planning process.

1.5 PLAN ORGANIZATION

The remainder of this plan is organized as follows:

- *Chapter Two* describes the existing regulatory environment and the relationship of the regulations to this planning effort.
- *Chapter Three* discusses information collection activities, including stakeholder involvement.
- *Chapter Four* describes existing study area characteristics, including planning area units and stream classifications.
- *Chapter Five* describes the problem identification and prioritization process and summarizes each problem identified.
- *Chapter Six* explains the analytical techniques used to assess specific problems and develop capital and programmatic recommendations.
- *Chapter Seven* is the Basin Plan, containing the plan recommendations.
- *Chapter Eight* contains the *Supplemental Environmental Impact Statement* for this Plan.
- *Appendix A* contains the Glossary
- *Appendix B* contains the 1991 Plan projects and their status.
- *Appendix C* contains a copy of the survey questionnaire sent to basin residents and a summary of questionnaire responses.
- *Appendix D* describes hydrologic and hydraulic analyses performed to develop recommendations for capital facilities.
- *Appendix E* contains detailed project descriptions and cost information backup.

CHAPTER TWO
Applicable Programs, Policies & Regulations

Numerous federal, State of Washington and local regulations, laws, policies and programs affect how stormwater and surface water are managed in unincorporated Pierce County. This chapter describes those pertinent to the Hylebos and Browns-Dash Point basins with an emphasis on coordination with other programs and consistency with adopted policies and plans. Federal regulations and programs are presented first and summarized in *Table 2-1*, followed by those of the State of Washington (State) summarized in *Table 2-2*, Pierce County (County), and other agencies.

2.1 FEDERAL REGULATIONS, POLICIES & PROGRAMS

2.1.1 Clean Water Act

National Pollutant Discharge Elimination System

In 1987, amendments to the federal *Clean Water Act* (CWA) required the Environmental Protection Agency (EPA) to promulgate regulations for storm water discharges. EPA defined certain stormwater discharges as point source discharges subject to federal regulations under the *National Pollutant Discharge Elimination System* (NPDES) Permit Program. Two broad areas were created as follows:

> "Stormwater Discharges Associated with Industrial Activity"
>
> "Municipal Separate Storm Sewer Systems" in two phases. Phase I applies to municipalities with populations greater than 100,000 people. Phase II requirements, which are expected to be implemented by 2005, apply to municipalities with populations of 10,000 people or more and certain urban areas.

EPA delegated responsibility for implementation of the NPDES permit program to the Washington State Department of Ecology (Ecology).

Ecology issued the “Phase I” NPDES permit for the South Puget Sound Water Quality Management Area (which includes Pierce County) in July 1995. It was administratively extended in 2000 pending development of a “Phase II” permit.

The NPDES stormwater permit requires that permit holders control pollutants in stormwater to the “maximum extent practicable.” The 1995 permit envisioned this as implementing a stormwater management program, a functional component of which is the basin plans. Future permits require additional water quality-based conditions.

Ecology approved Pierce County's Stormwater Management Program in 1998. Required elements include:

- A program to control runoff from new development, redevelopment, and construction sites
- Treatment and source control measures for existing commercial and residential areas
- An operation and maintenance program for new and existing stormwater facilities
- Practices for maintaining public streets and highways to reduce stormwater runoff impacts
- A program to include water quality considerations in flood management projects
- A program to reduce pollutants from pesticide and fertilizer use
- A program to detect, remove, and prevent illicit discharges to the municipal separate storm sewer system
- A program to reduce stormwater pollution from industrial facilities that discharge into the separate storm sewer system. An educational program for residents, businesses, industries, construction contractors, government employees, and others
- A monitoring plan to determine the effectiveness of program activities
- Reporting requirements
- Coordination among jurisdictions sharing water bodies

Relationship of the Current Stormwater NPDES Permit to the Hylebos Browns-Dash Point Basin Plan:

Recommendations of the Basin Plan support the County's Stormwater NPDES Permit requirements cited above and provisions of the Pierce County Stormwater Management Program (SWMP).

Section 303(d) List and Total Maximum Daily Loads

Section 303(a, b, and c) of the CWA requires that states establish standards to protect the quality of the waters of the United States.

Ecology classified all major bodies of water in Washington based on their current or potential beneficial uses and established a set of water quality standards for each class. *Section 303(d)* of the CWA requires Ecology to prepare a list of water bodies that are not meeting, or will not meet water quality standards, after application of the required technology-based effluent limits.

Ecology submitted its candidate Section 303(d) list for 1998 to EPA in June 1998[1]. Segments of Hylebos Creek and Commencement Bay were on the list as water bodies that do not meet the standards (for additional information, see *Chapter Four*).

If a waterbody is not in compliance with standards for a particular pollutant, the CWA requires that a total maximum daily load (TMDL) of the pollutant be calculated. The TMDL is the maximum amount of the pollutant that can be discharged to the waterbody without violating the water quality standard for the pollutant.

Limits for all pollutant sources discharging to the water body are adjusted downward until the TMDL can be met.

Relationship of 303(d) listings and TMDLs to the Hylebos Browns-Dash Point Basin Plan: Pierce County's current NPDES stormwater permit requires that the stormwater management program be amended to take into account TMDLs within 4 months of their promulgation. If a basin contains a water body that is on the Section 303(d) list but has not yet had a TMDL calculated, then implementation of the basin plan should address the TMDL and water quality control measures that address the listed pollutant(s).

Capital improvement projects and other control measures recommended for the drainage areas of water bodies identified in the 1998 303(d) list should be designed with the objective of removing the water body and listed parameter from the 303(d) list.

Section 404 Permits for Discharge of Fill Material to the Waters of the United States

Placement of fill in waters of the United States (U.S.) is regulated under Section 404 of the CWA. For the purposes of Section 404, waters of the United States are defined as wetlands adjacent to streams with flow greater than five (5) cubic feet per second and isolated wetlands greater than one acre that are hydraulically connected to regulated streams. Storm drainage projects that involve filling or work in small areas of wetlands may be permitted under one of several nationwide general permits. An individual permit, which is subject to a broader level of review, must be obtained for projects that that exceed the limits for nationwide permits. (Work in navigable waters (below MHHW) may require *Section 10* permits, which are also administered under the CWA. Activities requiring Section 10 permits include structures (e.g., piers, wharfs, breakwaters, bulkheads, jetties, weirs, transmission lines) and work such as dredging, disposal of dredged material, excavation, filling, or other modifications to the navigable waters of the United States.)

In Pierce County, Section 404 permits are issued and administered by the U.S. Army Corps of Engineers (Corps), Seattle District. The goal of Section 404 is to protect the nation's aquatic environment, which includes wetlands.

[1] Ecology submitted its combined 2002-04 list to EPA while this Plan was under development. That list was approved too late to be considered in this Plan; however, projects designed under this Plan will be subject to the new 303d List.

Relationship of Section 404 Regulations to the Hylebos Browns-Dash Point Basin Plan:
Aquatic resource protection argues for several basin plan approaches. First, wherever possible wetlands, riparian habitat and floodplain areas can be acquired to conserve the natural stormwater runoff and flood storage capacities they provide. Second, the cost estimates of future storm drainage facilities should include the costs of compensatory mitigation. Third, basin plans can identify new or revised programs designed to protect existing wetlands or create wetlands. Fourth, basin plan recommendations can be prioritized, in part, upon the extent to which aquatic resource protection and enhancement can be achieved.

2.1.2 Endangered Species Act

The ESA directs the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) Fisheries[2] to promulgate a list of endangered and threatened species and designate critical habitat for the listed species. Listed species with the greatest potential to affect surface water management in Pierce County are the chinook salmon (listed as threatened in March 1999) and the bull trout (listed as threatened in October 1999). NOAA Fisheries has indicated that additional salmonid species may be listed in the next few years. Chinook salmon have been found in Hylebos Creek (see *Chapter Four*).

Section 9 of the ESA prohibits "taking" of endangered species. To "take" means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct". The regulation explains that "harm" may include "significant habitat modification where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering".

If a proposed action requires a permit from a federal agency or is federally funded, and it could have an effect on a listed species, then Section 7 of the ESA requires the involved federal agency to consult with USFWS or NOAA Fisheries. After consultation, USFWS or NOAA Fisheries issues a biological opinion regarding the effects of the action. If USFWS or NOAA Fisheries finds that the action could jeopardize the continued existence of the species, the action cannot be permitted. If they find that the continued existence of the species is not jeopardized, then one of the agencies will issue an "Incidental Take Statement" and allow the action to proceed.

Section 4(d) of the ESA requires USFWS and NOAA Fisheries to adopt regulations as necessary to conserve the species listed as threatened. USFWS typically applies the Section 9 "take" prohibitions directly to threatened species. NOAA Fisheries typically promulgates "4(d) rules" that identify specific activities that can be conducted without constituting an unlawful take of the threatened species.

Pierce County has policies and programs that help to preserve and restore salmonid habitat. The County is implementing early actions to preserve and restore salmonid habitat in coordination with King and Snohomish Counties. NOAA Fisheries has approved a set of transportation

[2] NOAA Fisheries was previously called the National Marine Fisheries Service.

maintenance procedures that if followed protect transportation maintenance projects from liability under ESA. Other early actions include culvert replacements to improve fish passage, and restoration and acquisition of key habitat.

Relationship of ESA to the Hylebos Browns-Dash Point Basin Plan:
The salmonid listings have a broad effect on storm drainage and surface water management plans. Water quantity and water quality, crucial features of fish habitat that can be affected while solving flooding and storm drainage problems, must be addressed to protect listed species. Coordination with the varied agencies working on fish habitat initiatives should be reflected in recommended solutions to prevent overlap or duplication of effort.

2.1.3 National Flood Insurance Program

In 1968, the U.S. Congress initiated the National Flood Insurance Program (NFIP) (Chapter 44 in the Code of Federal Regulations (CFR)) under the National Flood Insurance Act to relieve the burden of disaster relief on the national treasury and state and local tax bases. The NFIP is administered by the Federal Insurance Administration, which is part of the Federal Emergency Management Agency (FEMA).

The NFIP makes available affordable flood insurance to communities that adopt approved floodplain management regulations. Federally subsidized flood insurance is available to local residents within identified flood hazard areas. Pierce County participates in the NFIP. To maintain coverage for county residents, the County must remain in the NFIP and maintain minimum floodplain management regulations.

Additionally, communities that do not participate in the NFIP have limited eligibility for federal flood disaster relief. FEMA's Flood Insurance Rate Maps (FIRMs) form the basis for critical area zoning for flood hazards. FEMA requires a certification letter for any revisions to a FIRM. Certification activities include stream channel modifications, installation of culverts, and bridge construction.

Flood hazard management regulations are codified in Title 18E.70 of the County Code and criteria and procedures are laid out in Chapter Nine of the *Pierce County Stormwater Management and Site Development Manual.*

Community Rating System

As an incentive for communities to do more than meet minimum NFIP requirements by taking actions to minimize flood losses and promote public awareness of flood hazards, FEMA created the Community Rating System (CRS). Community participation in the CRS is voluntary.

The CRS offers reduced insurance rates based upon the class rating of a community. The CRS contains ten classes. "Class 1" gives the greatest insurance premium reduction. A "Class 10" community receives no premium reduction. Pierce County was the first county in the nation to earn a "Class 5" rating.

Relationship of the NFIP and the CRS to the Hylebos Browns-Dash Point Basin Plan:
Basin plans serve as part of the flood hazard mitigation plan for Pierce County. The Hylebos Browns-Dash Point Basin Plan has been developed to meet or exceed the following criteria:

Floodplain Management Planning Elements - CRS Planning Steps

- Organize – Use a steering committee of department staff
- Involve the public – Engage people living and working in floodplains to identify problems, community goals and alternatives that will solve problems
- Coordinate with other local governments in the planning area, state and federal agencies, Indian tribes, and other Pierce County departments and programs
- Assess the hazard(s)
- Assess the problem(s)
- Set goals
- Review possible activities
- Draft an action plan
- Adopt the plan
- Implement the plan, evaluate it periodically, and revise it as needed to keep it current and effective

Table 2-1
Federal and Laws and
Hylebos Browns-Dash Point Basin Plan

Federal Laws	Application to the Hylebos Browns-Dash Point Basin
Clean Water Act. Section 402 National Pollutant Discharge Elimination System	Consistency with requirements of Pierce County Stormwater NPDES Permit
Clean Water Act. Section 303(d) Total Maximum Daily Load Listing	Must consider ways of reducing stormwater contributions to pollutant loads
Clean Water Act. Section 404 Permit Requirements for Discharges of Fill Material to Waters of the U.S.	Pierce County provides direction for basin plans to avoid recommendations that would have negative impacts on wetlands
Endangered Species Act	Consistency between the Basin Plan & Tri-County Endangered Species Act Response Implementation of the Puyallup WRIA Conservation Plan
National Flood Insurance Program	Consistency of Basin Plan recommendations with NFIP objectives, CRS standards, and Pierce County Flood Hazard Management Code

Source: Pierce County Water Programs

2.1.4 Settlement Agreement with the Puyallup Tribe

In 1989, the U.S. Congress passed the "Agreement between the Puyallup Tribe of Indians, Local Governments in Pierce County, the State of Washington, the United States of America, and certain private property owners" (Settlement Agreement). Pierce County signed the Settlement Agreement in 1988. In the Settlement Agreement, the parties agreed that, "The Tribe's treaty fishery must be managed to achieve increased salmon and steelhead production, including protection of necessary habitat, while providing for residential, commercial, industrial and other development, natural resource use, and protection of lives and property from flooding."

The parties agreed to consult with one another regarding major actions within the 1873 Survey Area (See *Figure 2.1).* Consultation consists of notification of a proposed major action, giving an opportunity for consultation and discussion, and making good faith efforts to accommodate the concerns of each party.

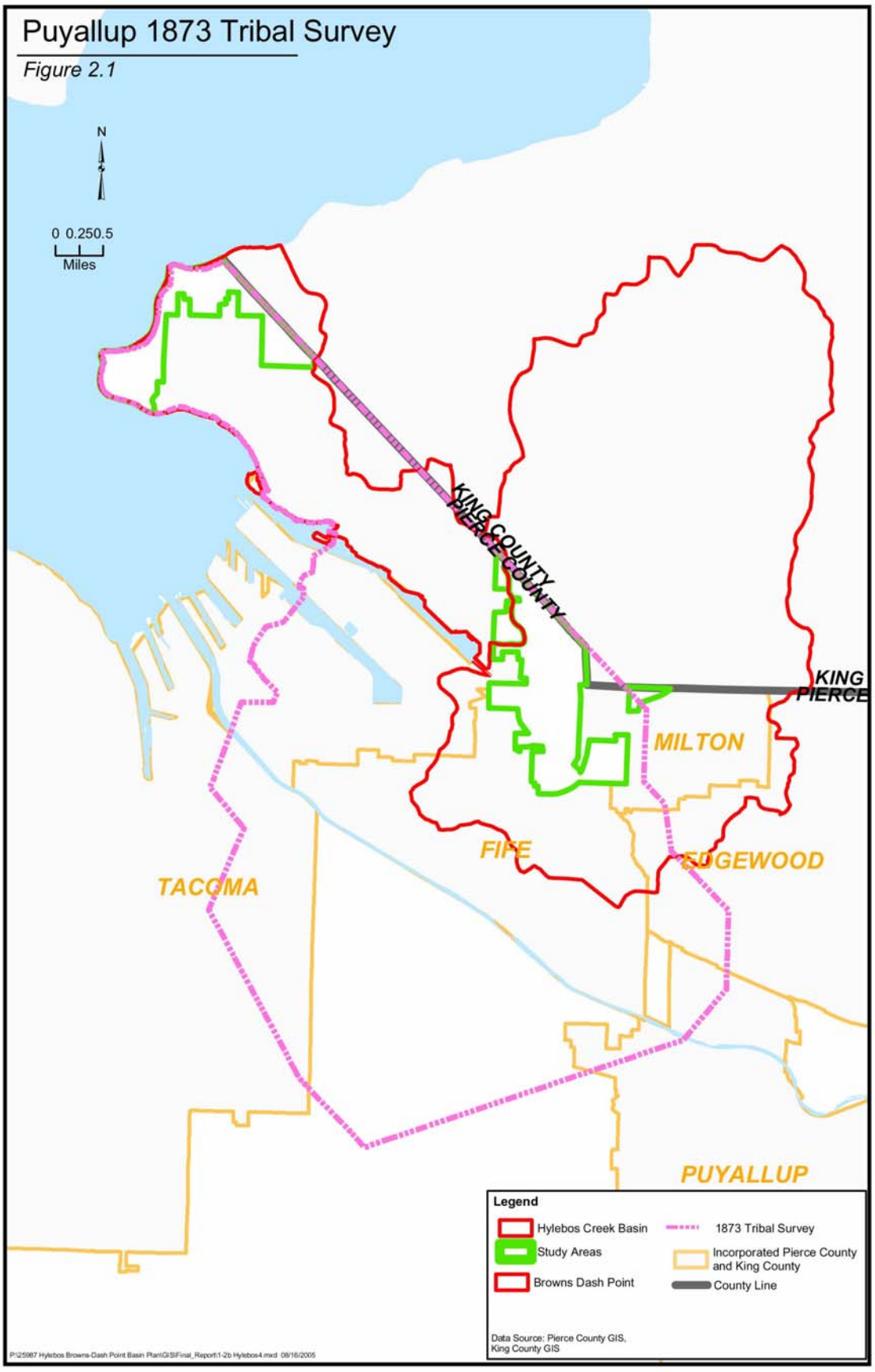
Relationship of the Settlement Agreement to the Hylebos Browns-Dash Point Basin Plan: The Settlement Agreement underscores the Basin Plan objective of protecting and enhancing fish habitat through stormwater and surface water management activities. It provides a basis for outreach between potentially affected parties when major actions the may affect water resources occur.

2.2 STATE REGULATIONS, PLANS AND PERMITS

2.2.1 State Water Quality Standards

Washington Administrative Code (WAC) 173-201A and 173-200 affect the discharge of stormwater to surface water and groundwater, respectively, by establishing water quality standards for each of the different classes of water and articulating the federal anti-degradation policy. WAC 173-200 also calls for designation of special groundwater protection areas based on unique characteristics (e.g., aquifer recharge areas, wellhead protection areas, or sole source aquifers).

In July 2003, Washington adopted a new set of water quality standards. The EPA has only partially approved the revised standards. The State uses the 2003 standards for the parts that EPA has approved, and uses the 1997 standards for the parts that EPA has approved. (See Ecology's website for the (http://www.ecy.wa.gov) for the adoption status.) Updated rules establish standards for temperature to protect temperature-sensitive fish, such as bull trout and Dolly Varden. A new indicator (enterococci) will be used to measure the amount of bacteria in marine waters that are not used for shellfish harvesting. New values for ammonia in waters without salmon species have been added.


Puyallup 1873 Tribal Survey
Figure 2.1
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Miles
KING COUNTY
PIERCE COUNTY
KING
PIERCE
MILTON
FIFE
EDGEWOOD
TACOMA
PUYALLUP
Legend
Hylebos Creek Basin
Study Areas
Browns Dash Point
1873 Tribal Survey
Incorporated Pierce County and King County
County Line
Data Source: Pierce County GIS, King County GIS
P:\25987 Hylebos Browns-Dash Point Basin Plan\GIS\Final_Report\1-2b Hylebos4.mxd 08/16/2005

Ecology will classify fresh waters by actual use (such as fish habitat, swimming and water supply), rather than by class (AA, A, B, C and Lake classes), to make the standards less complicated to interpret and provide future flexibility as the uses of a waterbody evolve.

Relationship of Water Quality Standards to the Hylebos Browns-Dash Point Basin Plan: Storm drainage and surface water management planning considers ground and surface water quality standards along with other factors when developing specific capital improvement alternatives, such as a large regional infiltration basin. This is largely because the standards are the foundation for other water quality programs such as NPDES permits, water clean-up plans (also known as TMDLs), and 401 Water Quality Certifications. Water quality standards are also used as benchmarks for developing recommendations for non-structural solutions.

2.2.2 Aquifer and Wellhead Protection

The Safe Drinking Water Act of 1974 (SDWA) transferred responsibility for regulation of drinking water to the EPA and called on the EPA to take a number of steps to protect the quality of the nation's drinking water supplies. EPA has set maximum contaminant levels in drinking water for more than 100 substances. Section 1424(e) of the SDWA established a Sole Source Aquifer Program. EPA was authorized to identify aquifers that are the only or principal source of drinking water for an area. The program also calls for EPA to review all federally funded projects planned for the area. Based on the review, the EPA administrator may withhold federal financial assistance for projects determined to be potential threats to a designated aquifer. In 1986, a new provision of the SDWA (Section 1428) required every state to develop a wellhead protection program to guard the quality of groundwater bodies used for water supply so that water arrives at a well uncontaminated. The Tacoma-Pierce County Health Department administers the wellhead protection program in Pierce County.

Relationship of Aquifer and Wellhead Protection Regulations to the Hylebos Browns-Dash Point Basin Plan: Basin plans take into account the locations of wells and wellhead protection requirements in siting new storm drainage facilities or recommending improvements to existing facilities. Stormwater infiltration facilities must be designed to meet groundwater quality standards or be sited to avoid areas where groundwater intersects aquifers providing potable water supplies.

2.2.3 The Growth Management Act and the Comprehensive Plan for Pierce County, Washington

The Growth Management Act (GMA) directed local governments of fast-growing counties, cities, and towns to prepare and adopt comprehensive plans and implementing regulations for managing their growth. Pierce County was required to prepare a comprehensive plan that meets the GMA precepts. The *Comprehensive Plan for Pierce County, Washington* (County Comprehensive Plan) became effective in December 1994. Development regulations to implement the County Comprehensive Plan were adopted in 1995.

Three GMA planning goals directly apply to storm drainage planning. They are as follows:

- "Urban growth. Encourage development in urban areas where adequate public facilities and services exist or can be provided in an efficient manner."

- "Environment. Protect the environment and enhance the state's high quality of life, including air and water quality, and the availability of water."

- "Public facilities and services. Ensure that those public facilities and services necessary to support development shall be adequate to serve the development at the time it is available for occupancy and use without decreasing service levels below locally established minimum standards."

The GMA influences the provision of storm drainage and surface water management services and facilities by requiring that: 1) frequently flooded areas (flood hazard areas) be identified and protected; 2) urban facilities be constructed in urban areas only; 3) a level of service standard be established for storm drainage facilities; and 4) capital improvements be identified to meet the adopted level of service given planned land use.

Relationship of the GMA to the Hylebos Browns-Dash Point Basin Plan:
The GMA mandates that comprehensive plans be internally consistent (Revised Code of Washington (RCW) 36.70A.070) and that counties perform their activities and make capital budget decisions in conformity with their comprehensive plans (RCW 36.70A.120). Because basin plans recommend capital improvement projects and form the basis of the annual capital budget for the County Storm Drainage and Surface Water Management Utility, basin plan recommendations are required to be consistent with the County Comprehensive Plan. Basin plans are also used to formulate the longer-term (six-year) capital improvement plan, also known as the "Capital Facilities Element" of the County Comprehensive Plan. (The *Supplemental Environmental Impact Statement* in Chapter Eight examines the consistency of this plan's recommendations with the County Comprehensive Plan).

Land use activities, determined by the County Comprehensive Plan and implementing regulations, can influence stormwater management infrastructure needs. The design of new facilities usually takes into account the impacts of zoning on potential future development within an area. Critical areas designations are used to determine the suitability of potential sites for stormwater facilities, such as infiltration ponds (aquifer recharge areas) or natural stormwater detention sites (wetlands and riparian corridors). Information in basin plans can influence land use too. An example would be that a basin plan might identify areas such as potholes where development could be restricted.

2.2.4 Shoreline Management Act

The Shoreline Management Act (SMA) establishes a broad policy for how Shorelines of the State can be used, giving preference to uses that:

- Protect the quality of water and the natural environment
- Depend on proximity to the shoreline (water-dependent uses)
- Preserve and enhance public access or increase recreational opportunities for the public along shorelines

Shorelines of the State include all marine waters, streams with a mean annual flow greater than 20 cubic feet per second; lakes 20 acres or larger; upland areas 200 feet landward from mean high water; biological wetlands; river deltas; and some or all of the 100-year floodplain, including all wetlands within the entire floodplain, when they are associated with one of the other listed waters.

The SMA divides authority for compliance between local and State governments. Cities and counties are the primary regulators. Each city and county adopts a shoreline master program and use regulations that are based on State guidelines but tailored to the needs of the community.

Pierce County adopted its Shoreline Master Program in 1974 and the Use Regulations in 1975 (amended, 1992). Shoreline use regulations have a permit system for administering the program.

Relationship of the Shoreline Master Program and Use Regulations to the Hylebos Browns-Dash Point Basin Plan: Many of the proposed projects contained in this Basin Plan are likely to be located within a regulated shoreline area that is subject to permit requirements. Those requirements influence design alternative choices. Conditions that might be imposed on recommended projects are considered in Chapter Eight, Supplemental Environmental Impact Statement, Land and Shoreline Use section.

2.2.5 State Hydraulic Code

The *Washington State Hydraulic Code* (RCW 77.55) regulates any activity affecting the bed or flow of the state's fresh waters and salt waters, in order to protect fish life. The Hydraulic Code is administered by the Washington State Department of Fish and Wildlife (WDFW).

The WDFW requires any person, organization, or government agency who constructs a hydraulic project to obtain a Hydraulic Project Approval (HPA) Permit. The HPA Permit typically specifies how construction projects are designed, managed, sequenced, and conducted to minimize adverse effects on fish and shellfish.

Relationship of the State Hydraulic Code to the Hylebos Browns-Dash Point Basin Plan:
Certain alternatives affect the bed and/or flow of surface water. Conceptual design and cost estimates for these facilities should take into consideration the conditions likely to be imposed on the project via the HPA Permit.

2.2.6 The Nonpoint Rule

WAC Chapter 400-12 established criteria and procedures for ranking watersheds in Washington State and for developing and implementing action plans for watersheds that need corrective and/or preventive actions.

The purpose of WAC 400-12 is to reduce pollutant loading from nonpoint sources, prevent new sources from being created, enhance water quality, and protect beneficial uses. The planning process encourages collaborative problem solving among local, state, tribal, and federal interests. It relies on voluntary actions, local ordinances, and state and federal laws, regulations, and programs for implementation.

Pierce County has prepared an action plan pursuant to this rule for the Lower Puyallup River, which includes the Hylebos Browns-Dash Point Basin. It is implemented by the Puyallup River Watershed Council, a group including citizens, Indian tribes, government agencies, businesses, and environmental groups with an interest in the watershed.

Relationship of the Nonpoint Rule to the Hylebos Browns-Dash Point Basin Plan:
The nonpoint action plan and its implementation should be considered when developing the basin planning strategy, basin-specific objectives and when evaluating projects.

Table 2-2
State Laws, Plans and Regulations
and Hylebos Browns-Dash Point Basin Plan

State Laws, Plans and Regulations	Application to the Hylebos Browns-Dash Point Basin
Water Quality Standards	Analyze water quality and develop projects & programs toward maintaining water quality standards and anti-degradation rule
Puget Sound Water Quality Management Plan	Drainage development standards; Stormwater Management Manual; Stormwater Pollution Control Manual
Growth Management Act	Critical areas regulations, consistency between comprehensive plans and capital improvement plans required
State Environmental Policy Act	Environmental review for basin plan and individual projects
Shoreline Management Act	Pierce County Shoreline Master Program (adopted as WAC)
State Hydraulic Code	Hydraulic Project approvals required for in-stream work
The Non-Point Rule	Puyallup WRIA Watershed Action Plan

Source: Pierce County Water Programs

2.3 PIERCE COUNTY REGULATIONS, POLICIES & PROGRAMS

2.3.1 Pierce County Storm Drainage and Surface Water Management Master Plan (Volumes 1 and 2), James M. Montgomery, 1991

The 1991 Plan is the original capital improvement program (CIP) and program plan for the Pierce County Storm Drainage and Surface Water Management Utility. It documents basin characteristics as of 1991, development of the CIP and refinement of alternatives. The Hylebos and Browns-Dash Point Basins were both studied.

The 1991 Plan describes physical attributes of the drainage basins, the drainage systems existing at the time; the hydrologic modeling performed and model results. It identifies alternatives and recommends CIPs specific to the Hylebos and Browns-Dash Point Basins.

Over the course of the fourteen years since adoption of the 1991 Plan, significant changes have occurred in the regulatory environment, program policies of federal and State funding agencies and Pierce County policy affecting stormwater management. In 1994, Pierce County adopted the County Comprehensive Plan, pursuant to the Growth Management Act. The implementing regulations have resulted in a change in stormwater and resource management standards. Portions of the study area have been annexed or have become incorporated.

In 1995, Pierce County secured a stormwater NPDES permit that requires the implementation of a Stormwater Management Program. These factors coupled with continuing land development and other changes in field conditions, have frequently ruled out projects originally recommended and have required that other alternatives be identified and implemented.

Appendix "A" presents the high priority projects recommended in the 1991 Plan for the Hylebos Browns-Dash Point Basins and reports how the recommendations have been implemented. It also provides a list of projects, identified after the 1991 Plan, that have been completed.

2.3.2 Studies and Reports

Others have completed studies and reports that include the Basin Plan study areas. A list and brief description of the documents reviewed during the development of the Basin Plan is as follows:

- ***Lower Puyallup Watershed Phase I Report***, Lower Puyallup Watershed Management Committee (LPWMC), March 1992. This report is the first phase of the Lower Puyallup Watershed Action Plan, which is an effort to solve the problems of nonpoint source pollution in the watershed. Phase I of the Action Plan provides a characterization of the basin, assesses water quality, defines the nonpoint water pollution problems, and describes the goals and objectives. The report includes a description of the Hylebos

Basin and mentions Browns-Dash Point Basin, which are sub-watersheds within the Lower Puyallup watershed.

- ***Lower Puyallup Watershed Action Plan,* LPWMC**, May 1995. This Action Plan calls for the creation of the Puyallup River Basin Council, which would oversee the implementation of the specified action items including monitoring efforts. The Actions Items are relevant to the Hylebos Browns-Dash Point Basins because they are part of the Action Plan planning area. This Plan was recognized by Resolution by the Pierce County Council on April 25th 1995 and approved by Ecology on May 5, 1995.

- ***Water Quality of the Lower Puyallup River Valley and Adjacent Uplands, Pierce County, Washington***, United States Geological Survey, Water Resources Investigation Report 86-4154, 1989. This report documents the water quality conditions within the Lower Puyallup watershed. Surface water and groundwater samples were collected and analyzed for a variety of pollutants within the Hylebos Basin.

- ***Analysis is the SR-167 Extension and Riparian Proposal in the Hylebos Watershed, Hydrology, Hydraulics and Geomorphology***, WDOT and consultants, Draft October, 2004. This report documented hydrologic, hydraulic and geomorphic evaluations conducted for affected segments of Hylebos Creek and the Surprise Lake Tributary with the Hylebos Creek watershed from the proposed SR 167 and I-5 HOV projects.

In addition to these studies, Pierce County completed a drainage inventory of the County-owned structures, pipes, and channels, and the data have been entered into the County's geographic information system (GIS) database. Data from this drainage inventory, as well as other GIS features available from the County, have been incorporated into this Plan.

CHAPTER THREE
Information Collection and Stakeholder Involvement

In order to identify Basin problems and potential opportunities, a variety of information collection activities were conducted, including:

- Review of documents related to the basins.
- Review of the County's *Service Response System* (SRS) database to identify reported concerns documented within the Basin study areas.
- Field reconnaissance of areas that have historically experienced problems with flooding and erosion.
- Mailing of a citizen questionnaire to Basin residents and compilation of results.
- Interviews with County and agency staff and some residents.
- Two public meetings in the study area.

3.1 DRAINAGE COMPLAINT DATABASE REVIEW AND FIELD RECONNAISSANCE

Members of the planning team conducted their initial tour of basin study areas in July of 2004 in order to observe and evaluate known problem sites. Prior to these field observations, team members reviewed the County's SRS database in order to identify target problem areas to visit. Problem sites visited included areas with both drainage and erosion problems. Additional site visits were conducted as needed during the analysis and development of the *Capital Improvement Plan* (*Chapters Six* and *Seven*). The additional site visits were conducted to obtain more information about existing conditions and drainage patterns, as well as options for improvements. The site visits also included a tour of the lower Hylebos with *Friends of the Hylebos* staff to identify potential reaches for collaboration on channel restoration activities.

3.2 CITIZEN QUESTIONNAIRE

The County's GIS database was queried to identify property owners that should receive the questionnaire. In the unincorporated Pierce County portions of the Browns-Dash Point Basin, the planning team identified property owners of parcels adjacent to streams or outfall pipes where problems might exist. In the unincorporated Pierce County portions of the Hylebos Basin, property owners of parcels directly adjacent to Hylebos Creek or tributaries were identified. Property owners of parcels along the outlet of Surprise Lake, exclusive of the large open parcels on the east side of Interstate 5, were also identified.

Water Programs then mailed a public outreach letter and questionnaire to all the identified property owners. *Figures 3-1* and *3-2* illustrate the locations of parcels targeted for the mailing. Some citizens of other jurisdictions received questionnaires if Water Programs thought they might be able to provide information regarding problems affecting Water Programs. A copy of the mailer sent by Water Programs is included in *Appendix C*. Nineteen responses to the mailing were received. The location of parcels whose owners responded to the mailing are indicated on the figures. Thirteen responses were received from property owners in the Browns-Dash Point Basin, and six were from property owners in the Hylebos Basin. *Appendix C* also summarizes the responses.

The questionnaires were screened as follows:

- All responses were plotted on a map to determine their correlation to known problems.
- Responses were screened to eliminate those that did not concern surface water problems (many responses focused on drinking water or other issues beyond the scope of this effort).
- Responses were screened to eliminate those that identified private rather than public problems. Private problems are those that are not caused by County surface water management activities or facilities, and that do not impact public facilities. An example of a private problem would be drainage from a house flowing across a property line and affecting an adjacent neighbor.

In general, the problems identified from the questionnaires were either already known to Water Programs, have already been addressed, or were fixes of private problems.

3.3 CONTACTS

Planning team members contacted County and public agency staff, including representatives from the following organizations:

- Pierce County Water Programs.
- Friends of the Hylebos (a local non-profit organization that works to protect and restore the environmental quality of Hylebos Creek, the West Hylebos wetlands, and the surrounding watershed).
- Pierce County Conservation District.
- Tacoma Pierce County Health Department.
- Washington State Department of Transportation (WSDOT).

Water Programs has also provided input opportunities to the Puyallup Tribe of Indians over the course of the project.

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0 1,000 2,000 3,000 4,000
Feet

Legend

- Study Area
- Basin Boundary
- County Line
- Tax Parcels
- Streams
- Waterbodies
- City Limits
- Proposed for Annexation
- Parcels Selected for Mailing

Commencement Bay

BIRCH ST NE
FOE AV NE
EAST SIDE DR NE
21ST AV NE
VASHON CT NE
BEVERLY AV NE
BROWNS POINT BLVD
RIDGE DR NE
23RD AV NE
LUTHALADA AV NE
WAUBETAU GA AV NE
52ND PL NE
45TH ST NE
36TH AV NE
40TH AV NE
NASSAU AV NE
42ND AV NE
35TH ST NE
33RD ST NE
37TH AV NE
32ND ST NE
TACOMA
50TH AV NE
53RD AV NE
54TH AV NE
54TH AV NE
55TH AV NE
56TH AV NE
57TH AV NE
58TH AV NE
31ST ST NE
29TH ST NE
28TH ST NE
27TH ST NE
26TH ST NE
25TH ST NE
E 11TH ST
MARINE VIEW DR
NORTHSHORE WY NE
63RD AV NE
65TH AV NE
18TH ST NE
PUBLIC
12TH ST NE
58TH AV NE
KING COUNTY
PIERCE COUNTY

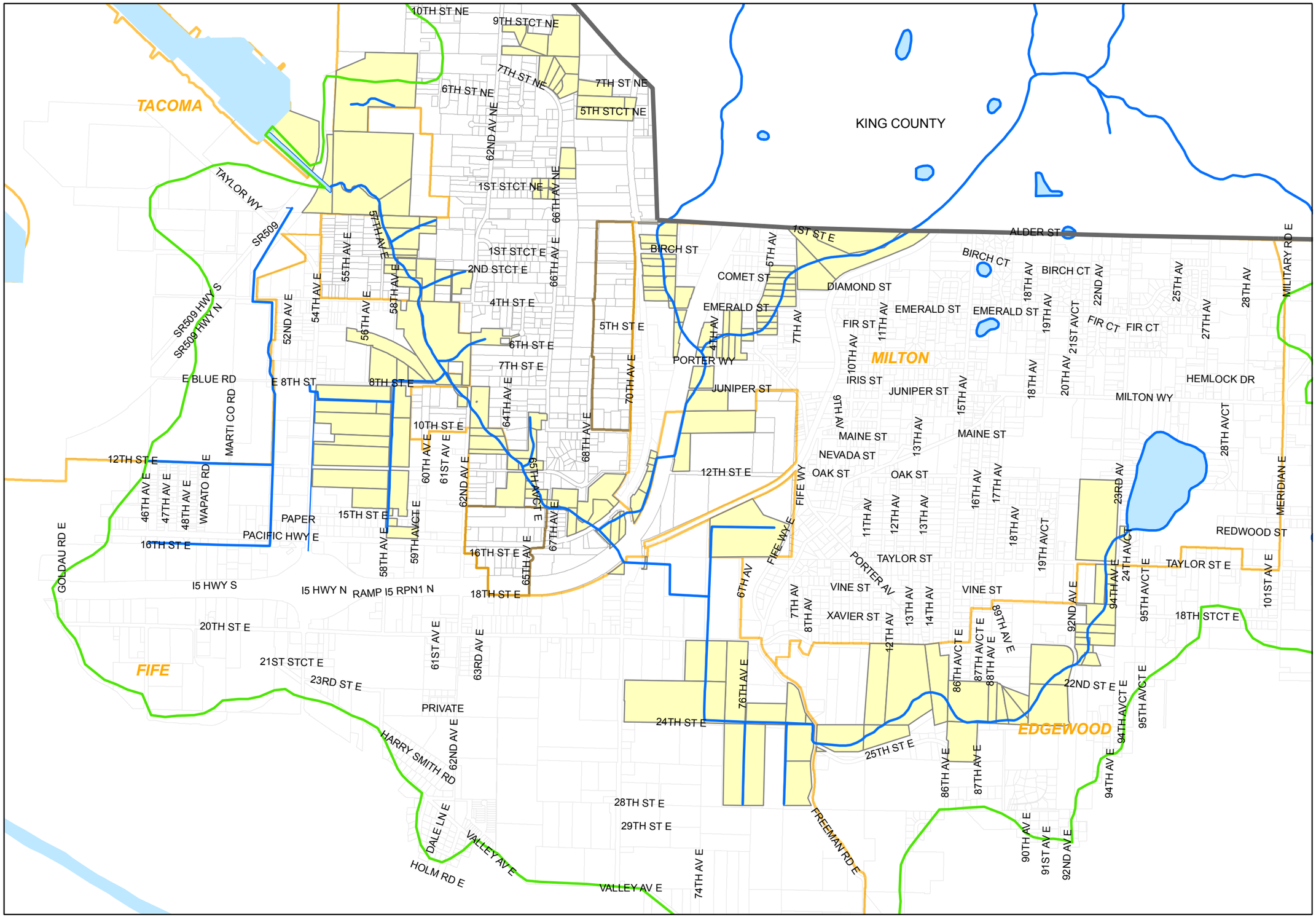
BROWN AND CALDWELL

Data Source: Pierce County GIS, King County GIS
Parcels selected by proximity to streams

P:\25987 Hylebos Browns-Dash Point Basin Plan\GIS\Final_Report\2-1 Browns-Dash_Mailing_Map.mxd 07/01/2005

Figure 3-1. Selected Parcels For Mailing

Browns-Dash Point Basin
Pierce County



BROWN AND CALDWELL

Data Source: Pierce County GIS, King County GIS
Parcels selected by proximity to streams

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Figure 3-2. Selected Parcels For Mailing

Hylebos Basin
Pierce County

3.4 PUBLIC MEETINGS

Spring 2005

Two public meetings were held in the spring of 2005 to present identified problems, potential solutions, and to solicit input from the general public. The cities of Fife, Milton, Edgewood, Tacoma, and Federal Way and the Puyallup Indian Tribe were also invited to attend. The first meeting was held at the Browns Point Improvement Club on April 28, 2005; and the second meeting was held at the Fife Community Center on May 3, 2005. *Appendix C* includes copies of the agenda for each meeting.

Seventeen residents attended the meeting at the Browns Point Improvement Club and provided the following input:

- Citizens are concerned about how projects in Browns Point would be rated against those in the Hylebos because they feel there are no fish streams in Browns Point. Consequently, they are concerned that their projects might not score as high as projects in the Hylebos Basin.
- Citizens were concerned that their locally collected fees would be taken out of their area to fix problems in other areas, like the Hylebos, instead of their own.
- Concerns were concerned about runoff that originates in the City of Tacoma and impacts them.
- Concern was raised about how development has affected drainage patterns. Water that used to sheet flow, is now concentrated in ditches and pipelines.
- Attendees felt that the County has historically allowed development (e.g., lot overbuilding) that has caused drainage problems. Before the County implemented the *Stormwater and Site Development Manual* and associated regulations, development projects were not required to consider and mitigate for downstream impacts.
- One resident with a large home at the bottom of a drainage course is concerned about capital improvement projects that might increase the collection efficiency of the local drainage system. He is worried that increased flows in the drainage where he lives could increase flood damage potential for his residence.
- It was generally acknowledged that groundwater seepage is a problem in the community due to local geology.
- Some residents are hoping that a community plan will help them resolve issues. There is also concern about potential annexation to Tacoma or Federal Way.
- Finally, attendees helped identify two new problems that were not known to Water Programs and were therefore added to the list of sites for investigation and development of recommendations.

Nine residents attended the meeting at the Fife Community Center and provided the following input:

- Citizens expressed concern about the potential for erosion if vegetation is removed to install pipelines down steep slopes.
- The B and L Woodwaste cleanup site is a concern due to the potential for groundwater contamination. Interest was expressed as to what is being done to remediate the problem.
- Some citizens were concerned that the SR 167 project may impact water quality.
- Citizens expressed curiosity as to when projects would be built after Plan adoption.
- One resident had observed a County completed drainage project in which they believed perforated pipe was inappropriately used in clay soils.
- Residents expressed a desire for Water Programs to think about fish habitat downstream of ravine stabilization projects for eroding areas.

While no representatives from the invited cities provided comments as a result of the public meetings, Water Programs anticipates receiving their comments following release of the public review draft of the plan. The entire Basin Plan area is within Urban Growth/Urban Growth Service areas for Tacoma, Fife and Milton. Coordination with these jurisdictions will be an important consideration in Plan implementation.

Spring 2006

Two public meetings were held to present the proposed draft basin plan. The first was held the afternoon of April 18, at the Fife Community Center. The second was held the evening of April 19 at the Browns Point Improvement Club. Meeting attendees were supportive of the Basin Plan. Comments received are addressed in Chapter 8 (FSEIS) of this document.

3.5 OTHER MEETINGS

The Basin Plan was presented to the *Pierce County Storm Drainage and Surface Water Management Advisory Board* (SWAB) at two meetings; December 15, 2005 and January 19, 2006. The SWAB is a group of individuals appointed to represent citizen interests in the county. The mission of the advisory board is to work with Pierce County Water Programs to develop recommendations on the County's surface water management program to the Pierce County Council and Executive Office. On January 19, 2006, the SWAB voted to approve and forward the Basin Plan to the County Council for referral to the Pierce County Planning Commission.

CHAPTER FOUR
Basin Characteristics

The Browns-Dash Point and Hylebos drainage basins are both located in northern Pierce County within the Puyallup *Water Resource Inventory Area* (WRIA 10). Irrespective of their inclusion in WRIA 10, both basins flow directly into Puget Sound (Commencement Bay, East Passage and the Hylebos Waterway) rather than into the Puyallup River. The Hylebos Basin covers 29 square miles (18,625 acres), and the Browns-Dash Point Basin covers 15 square miles (9,589 acres). Both drainage basins straddle the Pierce/King County boundary. Because of incorporations by the cities of Tacoma, Fife and Edgewood, there is relatively little area of each drainage basin that is in unincorporated Pierce County. Within the Browns-Dash Point Basin, 758 acres (7.9 percent of the basin area) are in unincorporated Pierce County. Within the Hylebos Basin, 950 acres (5.1 percent of the area) are in unincorporated Pierce County. This Plan focuses on the unincorporated Pierce County portions of the drainage basins, also referred to as the study areas.

4.1 BROWNS-DASH POINT BASIN

The following sections describe drainage, floodplains and wetlands, geology and soils, and zoning and land use in the Browns-Dash Point Basin.

4.1.1 Drainage

The Browns-Dash Point Basin is located upon a "peninsula-like" feature northeast of the city of Tacoma. It slopes gently to the west to Puget Sound, and more steeply toward the southwest to Commencement Bay. The study area is comprised of several smaller drainages. Most of these drainages begin near the top of the bluffs and drain to ravines which discharge directly into Puget Sound. There are a total of 28 stormwater outfalls in the study area that have been identified as discharging directly to Puget Sound. There are some headwaters in the northern part of the study area that that discharge north into King County before flowing into the Puget Sound. In addition, a significant amount of flow enters the study area from upstream tributary areas that are within the city of Tacoma. *Figure 1-2a* is a map of the Browns-Dash Point Basin. *Section 4.3* discusses drainage sub-basins relative to the study area boundaries.

Land use in the Browns-Dash Point Basin has long been residential. Development in the area did not occur in a comprehensive manner, but rather on a lot-by-lot basis. Most of the drainage infrastructure consists of open roadside ditches and pieced together pipe systems that were designed to meet the needs of the individual projects for which they were installed. Retention and detention ponds were not used, since most development occurred prior to the requirement for detention.

The majority of the development occurred prior to establishment of design standards that require consideration of upstream stormwater flows and future development impacts. The result is that the lower portions of the stormwater system tend to be undersized and may be overwhelmed by the stormwater flows that have been created over the years. Development has encroached upon many of the stormwater facilities and easements in the Browns-Dash Point Basin to the point of creating obstacles for maintenance activities.

4.1.2 Floodplains and Wetlands

Figure 4-1 shows floodplains and wetlands in the Browns-Dash Point Basin. The floodplain boundaries are based on 1995 Federal Emergency Management Agency (FEMA) Q3 Flood Data. The data is derived from the FEMA Flood Insurance Rate Maps. The "A Zone" represents a 100-year flood hazard area, an area estimated to have a one percent chance of flooding in any given year, or a one-in-100 year chance. The "X500 Zone" (formerly referred to as "B Zone") represents the 500-year flood hazard area, an area estimated to have a 0.2 percent chance of flooding in any given year, or an area with a high risk of flooding that has a small drainage basin (less than one square mile). The Browns-Dash Point Basin has a mapped "A Zone" flood hazard area along the Commencement Bay and Hylebos Waterway shoreline that illustrates areas of potential coastal flooding. This is the only mapped flood zone area in the study area.

Figure 4-1 also shows mapped wetlands in the Browns-Dash Point Basin study area. There are very few wetlands mapped in the area[1]. The wetlands shown on the map have been rated as "Category 3" wetlands.

The wetland categories represented on the figure were assigned pursuant to Pierce County *Critical Area Regulations* that were effective until March 1, 2005. A "Category 3" wetland under that system was typically a wetland that lacked significant habitat and diversity of vegetation classes. If the wetlands are reevaluated under the current rating criteria, the categories could change. Current rating criteria for wetlands are contained within *Section 18E.30.70, "Appendix A" of Pierce County Code Title 18E* and the *Washington State Wetland Rating System for Western Washington*, revised April 2004 (Ecology Publication #04-06-025).

4.1.3 Geology and Soils

The Browns-Dash Point Basin encompasses a variety of geologic terrains (*Hylebos Creek and Lower Puget Sound Basins, Current and Future Conditions Report*, July 1990). Geologic terrains, for purposes of this discussion, are physical features of the land, such as topography and soil layering. These terrains, the result of glacial activity, influence the patterns of surface water runoff, groundwater flow and slope stability.

[1] The County wetland inventory does not contain all wetlands, there may be additional wetland areas that are not yet mapped.

Browns-Dash Point Basin

Figure 4-1. Browns-Dash Point Floodplain and Wetlands

Legend

- Study area
- Browns/Dash-Point Basin
- Waterbodies
- Tidal Flat
- Streams
- Streets
- Puget Sound
- County border
- City Limits

Floodzone

- 100 year (A Zone)
- 500-year (X500 Zone)

Wetlands

- Uncategorized
- I
- II
- III
- IV

Data Source: Pierce County GIS, King County GIS

N

0 0.25 0.5
Miles

BROWN AND CALDWELL

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The numerous advance and retreat cycles of glacial ice have shaped the Puget Sound Basin by depositing and consolidating material. Along the shorelines, glacial ice carved drainages in the uplands; later, wave action resulted in steep slopes in these drainages. The glacial activity has resulted in a mixture of layers of highly permeable outwash deposits and relatively impervious layers of till or other sediment.

Outwash consists of loose, stratified sands and/or gravels deposited by glacial meltwater streams. Surficial outwash deposits occupy only minor portions of the uplands. Till is a very compact, unsorted, and unstratified mixture of pebbles and gravels in a matrix of sand, silt, and clay deposited by glaciers. Deposits of glacial till, resembling concrete in appearance, mantle most of the study area uplands.

Figure 4-2 shows the soil types of the area. Soils affect infiltration rates, the potential for erosion, and slope stability. The soils in the Browns-Dash Point Basin are predominantly of the Alderwood-Everett Association, as identified by the Soil Conservation Service. Soils of this association consist primarily of soils formed in glacial till and glacial outwash on uplands.

Among the soils of the Alderwood-Everett Association which occupy portions of the study area are the Alderwood, Kapowsin, Indianola, Everett, and Kitsap series. Alderwood and Kapowsin series soils are formed in glacial till and represent the most extensive soils in the upland regions. Alderwood soils consist of approximately 36 inches of gravelly sandy loam overlying compact glacial till. Kapowsin soils consist of approximately 25 inches of gravelly loam, overlying compact glacial till. A water table seasonally perches on the glacial till surfaces in both soils.

The Everett and Indianola series are formed in gravelly glacial outwash deposits and sandy glacial outwash deposits respectively. These soils are deep and somewhat excessively drained soils. The Kitsap series soils are formed in lacustrine deposits found in the northern portion of the Browns-Dash Point Basin. Lacustrine deposits are lake-bed silts and clays. Such deposits are common along the eastern and southern slopes of Fife Heights. The moderately erodible Kitsap soil consists of approximately 17 inches of silt loam overlying silty clay loam. A water table perches seasonally on the slowly permeable, silty clay loam subsoil.

Outwash/till layering commonly results in springs or groundwater seeps. Springs or seeps occur when rainfall infiltrates in the more pervious outwash soils, collects on top of the relatively impermeable till layer, migrates down gradient, and then surfaces at an exposed interface (e.g., road cut or basement excavation). This is a common condition in the Browns-Dash Point Basin, and often results in basement flooding or other drainage problems. Hence, while the outwash soils in the study area may rapidly infiltrate storm water, the prevalence of groundwater flooding limits the applicability of infiltration-based projects.

4.1.4 Zoning and Land Use

The Browns-Dash Point Basin is located within the Pierce County *Urban Growth Area*. The study area is primarily zoned moderate density single family residential with a small area of mixed use for a neighborhood center as shown in *Figure 4-3*. Actual land use is approximately 56 percent residential (*Table 4-1* and *Figure 4-4*).

Table 4-1
Existing Land Use – Browns-Dash Point Basin

Existing Land Use	Area (acres)	Percent of Study Area
Commercial/Industrial	5.2	0.8
Open Spaces/Resource Lands	19.6	3.0
Public Places/Religious Centers	50.5	7.6
Residential	368.4	55.7
Transportation	4.9	0.7
Vacant/Undefined	213.1	32.2

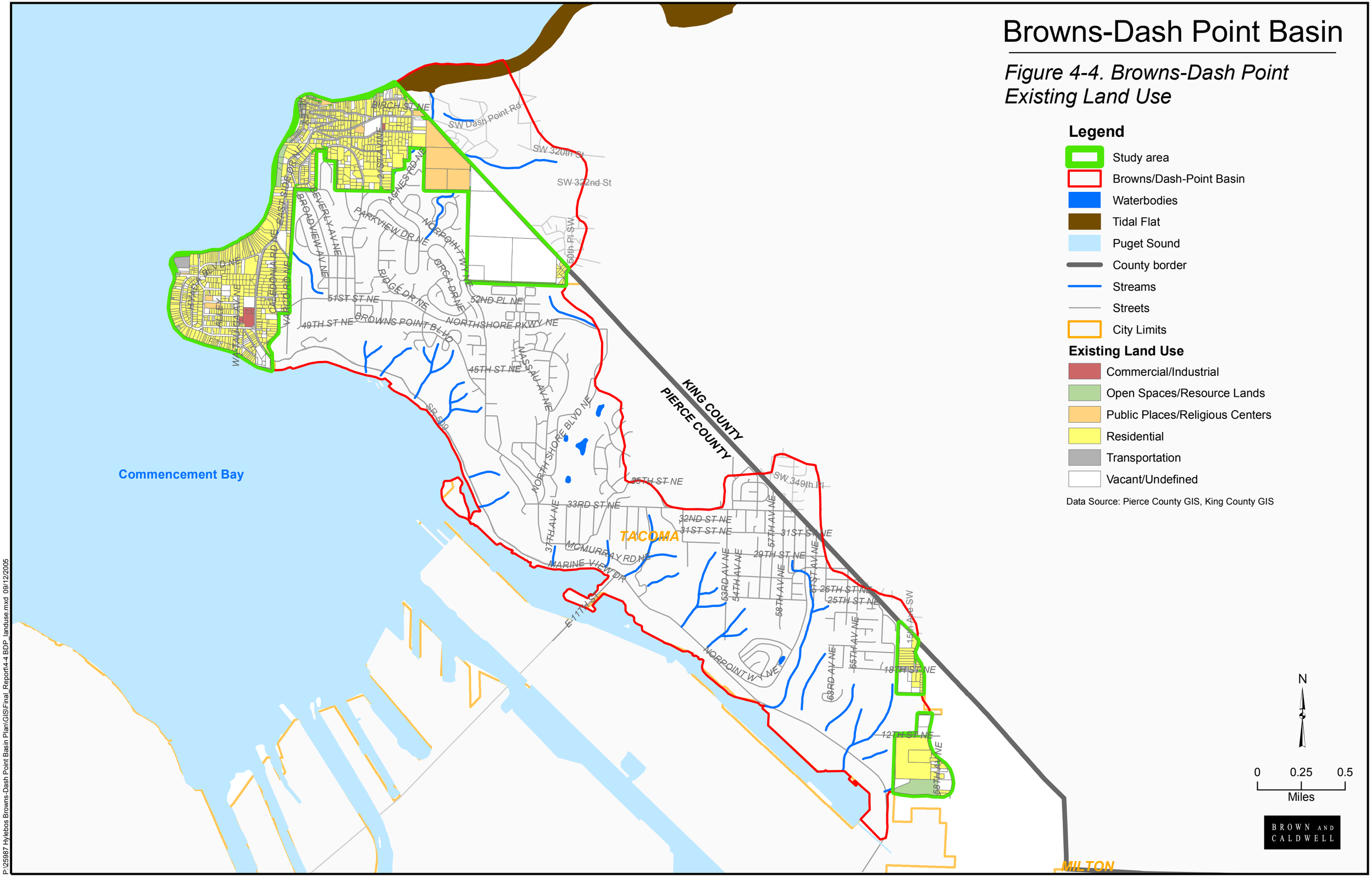
The basin is approaching full build-out with the highest levels of development along the shorelines. Inland, there are larger tracts of land that may ultimately be developed. However, these parcels tend to include steep slopes, streams and other environmental constraints that will delay, or possibly limit their development. *Figure 4-5* is a map of buildable lands in the Browns-Dash Point Basin. This map was developed by Pierce County and illustrates four land development designations: vacant, underdeveloped, redevelopable, and developed (*Pierce County Buildable Lands Report,* 2002).

According to the report, vacant lands, "encompass parcels without an established structure or land use, including agricultural and resource lands." Underdeveloped lands include, "large parcels within residential districts that have with an existing single-family residence that may be further subdivided and existing single-family residences that are located within commercial districts." Redevelopable lands are, "commercially zoned properties containing buildings of questionable economic viability."

As can be seen from the map, large areas (approximately 57 percent of the study area) of the Basin are developed. See *Table 4-2*. The undeveloped area includes a large area abutting the King County border that is designated as vacant, but is likely part of the Dash Point State park. This area accounts for approximately 17 percent of the study area. If this area were to remain vacant, the amount of developable (vacant, underdeveloped, or redevelopable) land is much less than the remaining 43 percent. Using the standard assumptions developed for the *2002 Buildable Lands Report* (*Table 6* and *Table 8* of the Report), of the remaining developable land area, only 40 percent of that remaining 43 percent is considered available for development, for a total of 113 acres. The rest is unavailable due to constraints such as critical areas, road and right

Browns-Dash Point Basin

Figure 4-4. Browns-Dash Point Existing Land Use



Legend

- Study area
- Browns/Dash-Point Basin
- Waterbodies
- Tidal Flat
- Puget Sound
- County border
- Streams
- Streets
- City Limits

Existing Land Use

- Commercial/Industrial
- Open Spaces/Resource Lands
- Public Places/Religious Centers
- Residential
- Transportation
- Vacant/Undefined

Data Source: Pierce County GIS, King County GIS

N

0 0.25 0.5
Miles

BROWN AND CALDWELL

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Browns-Dash Point Basin

Figure 4-3. Browns-Dash Point Zoning

Legend

- Study area
- Browns/Dash-Point Basin
- Waterbodies
- Tidal Flat
- Puget Sound
- County border
- Streams
- Streets
- City Limits

Zoning Name

- Moderate Density Single Family
- Neighborhood Center

Data Source: Pierce County GIS, King County GIS

Commencement Bay

BIRCH ST NE
ALLEY
21ST AV NE
EAST SIDE DR NE
SW Dash Point Rd
SW 320th St
SW 322nd St
AGNES RD NE
BEVERLY AV NE
BROADVIEW AV NE
PARKVIEW DR NE
NORPOINT WY NE
50th Pl SW
HYADA BLVD NE
ALLEY
WA-TAU-GA AV NE
CALEDONIA RD NE
WARCO RD NE
51ST ST NE
RIDGE DR NE
ORCA DR NE
52ND PL NE
49TH ST NE
BROWNS POINT BLVD
NORTHSHORE PKWY NE
45TH ST NE
NASSAU AV NE
SR 509
NORTH SHORE BLVD NE
KING COUNTY
PIERCE COUNTY
35TH ST NE
SW 349th Pl
37TH AV NE
33RD ST NE
32ND ST NE
31ST ST NE
TACOMA
MCMURRAY RD NE
MARINE VIEW DR
57TH AV NE
31ST ST NE
29TH ST NE
53RD AV NE
54TH AV NE
58TH AV NE
57TH AV NE
26TH ST NE
25TH ST NE
E 11TH ST
NORPOINT WAY NE
65TH AV NE
68TH AV NE
18TH ST NE
12TH ST NE
58TH AV NE
MILTON

N

0 0.25 0.5
Miles

BROWN AND CALDWELL

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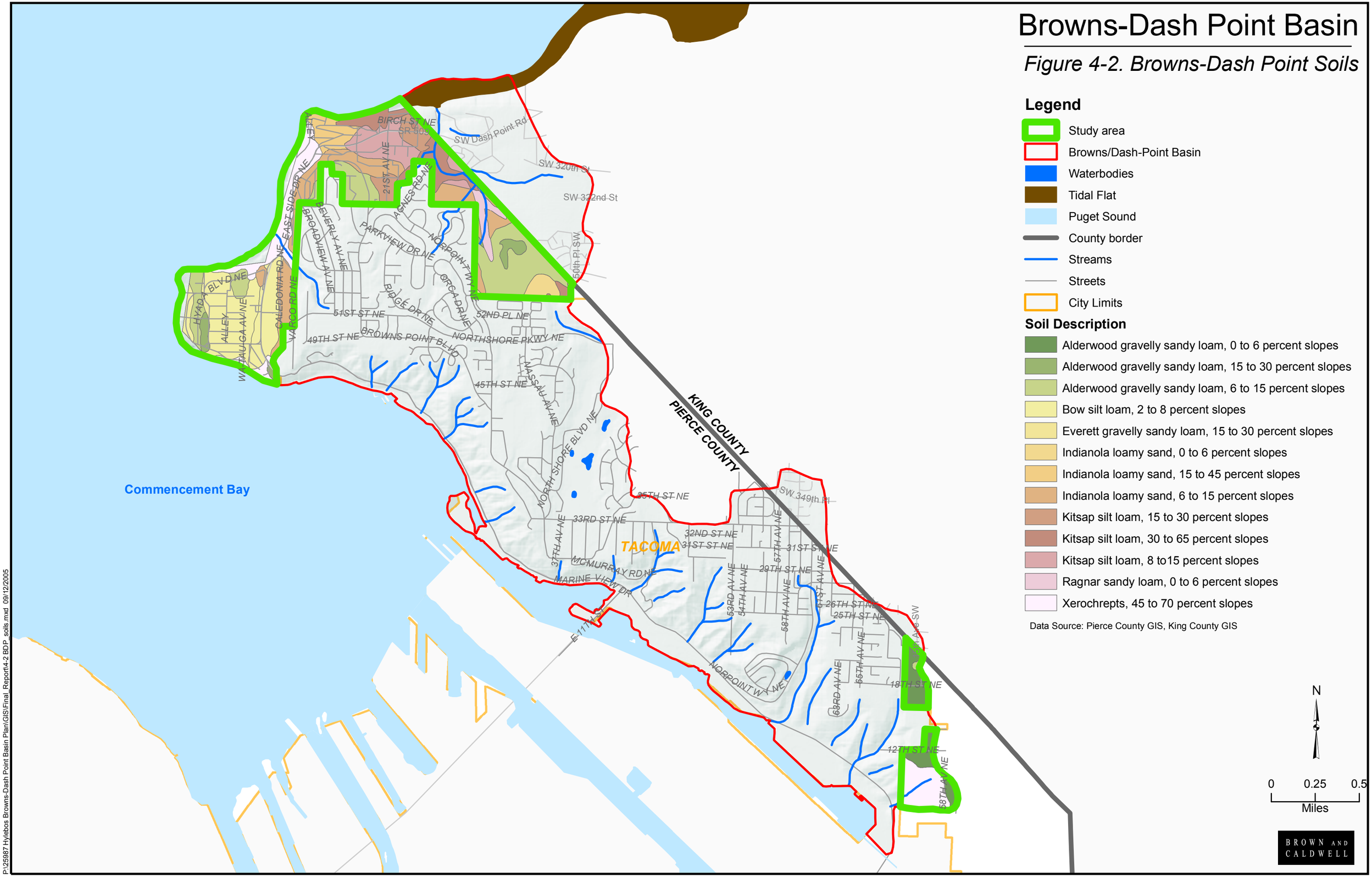
Browns-Dash Point Basin

Figure 4-2. Browns-Dash Point Soils



Legend

- Study area
- Browns/Dash-Point Basin
- Waterbodies
- Tidal Flat
- Puget Sound
- County border
- Streams
- Streets
- City Limits

Soil Description

- Alderwood gravelly sandy loam, 0 to 6 percent slopes
- Alderwood gravelly sandy loam, 15 to 30 percent slopes
- Alderwood gravelly sandy loam, 6 to 15 percent slopes
- Bow silt loam, 2 to 8 percent slopes
- Everett gravelly sandy loam, 15 to 30 percent slopes
- Indianola loamy sand, 0 to 6 percent slopes
- Indianola loamy sand, 15 to 45 percent slopes
- Indianola loamy sand, 6 to 15 percent slopes
- Kitsap silt loam, 15 to 30 percent slopes
- Kitsap silt loam, 30 to 65 percent slopes
- Kitsap silt loam, 8 to15 percent slopes
- Ragnar sandy loam, 0 to 6 percent slopes
- Xerochrepts, 45 to 70 percent slopes

Data Source: Pierce County GIS, King County GIS

N

0 0.25 0.5

Miles

BROWN AND CALDWELL

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Browns-Dash Point Basin

Figure 4-5. Browns-Dash Point Buildable Lands

Legend

- Study area
- Browns/Dash-Point Basin
- Waterbodies
- Tidal Flat
- Puget Sound
- County border
- Streams
- Streets
- City Limits

Buildable Lands Inventory Code

- Vacant
- Underdeveloped
- Redevelopable
- Developed

Data Source: Pierce County GIS, King County GIS

Commencement Bay

KING COUNTY
PIERCE COUNTY

TACOMA

BIRCH ST NE
SW Dash Point Rd
SW 320th St
SW 322nd St
ALLEY
EAST SIDE DR NE
21ST AV NE
AGNES RD NE
BEVERLY AV NE
BROADVIEW AV NE
PARKVIEW DR NE
NORPOINT TW NE
50th Pl SW
HYADA BLVD NE
ALLEY
WAHTAU GA AV NE
CALEDONIA RD NE
VARCO RD NE
RIDGE DR NE
ORCA DR NE
51ST ST NE
52ND PL NE
49TH ST NE
BROWNS POINT BLVD
NORTHSHORE PKWY NE
45TH ST NE
NASSAU AV NE
NORTH SHORE BLVD NE
SR 509
35TH ST NE
33RD ST NE
37TH AV NE
32ND ST NE
31ST ST NE
MCMURRAY RD NE
MARINE VIEW DR
E 11TH ST
57TH AV NE
31ST ST NE
29TH ST NE
53RD AV NE
54TH AV NE
58TH AV NE
61ST AV NE
26TH ST NE
25TH ST NE
NORPOINT W LN NE
63RD AV NE
65TH AV NE
18TH ST NE
12TH ST NE
68TH AV NE
SW 349th Pl

N

0 0.25 0.5
Miles

BROWN AND CALDWELL

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of way construction, and public facilities. Excerpts from the *2002 Buildable Lands Report* are contained within *Appendix D*.

Table 4-2
Buildable Land Areas – Browns-Dash Point Basin

Land Development Designation	Area (acres)	Percent of Study Area
Vacant	218.5	33.1
Underdeveloped	62.9	9.5
Redevelopable	1.9	0.3
Developed	376.4	57.1

According to 2000 census data, the population in the study area (which was calculated within unincorporated Pierce County only) was 2,027. In 2004, the population was estimated to be 2,163 or an approximately 7% overall increase (1.8% per year increase). According to estimates made by Pierce County Public Works and Utilities staff as part of the *Traffic Fee Impact Study* in Spring 2005, the population in the study area is projected to increase to 3,533 by the year 2025 (Shawn Phelps, personal communication) an approximately 63% increase over a 21-year period (3% average increase annually). The area is projected to increase from a total of 951 households in 2004, to 1380 households in 2025.

Developed areas in the Browns-Dash Point Basin are either on septic or sanitary sewer. The older developments tend to be on septic systems. *Figure 4-6* shows which portions of the study area are served by sanitary sewer systems. As can be seen from the figure, a substantial portion of the basin study area, including waterfront parcels around Dash Point, are unsewered.

4.2 HYLEBOS BASIN

The following sections describe drainage, floodplains and wetlands, geology and soils, and zoning and land use in the Hylebos Basin.

4.2.1 Drainage

Two major tributaries of Hylebos Creek, the West and East Forks, originate in King County. The forks are on the west and east sides of Interstate 5 and join south of the King/Pierce County border, along the eastern edge of I-5. Surprise Lake, located in the city of Milton, feeds another major tributary that joins Hylebos Creek near where it turns northwest and crosses under SR 99. *Figure 1-2b* illustrates the Hylebos Basin.

The headwaters of the West Fork of the Hylebos are in King County in the city of Federal Way, near South 320th street. Drainage areas in the headwater areas are highly developed with commercial land uses. The West Fork has two significant tributaries. The western tributary extends to the The Commons (SeaTac Mall) and Panther Lake. The two branches converge in a protected area near Brook Lake in Hylebos State Park. The West Fork continues south through private, undeveloped, large lots west of SR 99 and then crosses under SR 99 to merge with the East Fork in an area known as Spring Valley. Hylebos Creek enters Pierce County and the city of Milton at the northern end of 2nd Avenue near Birch Street. Spring Valley is mostly pasture land, large lots with hobby farms, cemeteries, parks, and open space. Hylebos Creek in Spring Valley has some of the best fish habitat, including spawning areas in the entire Basin.

The East Fork of Hylebos Creek begins in King County near North Lake and Lake Killarney and flows southward to the confluence with the West Fork. The East Fork Sub-basin is relatively narrow, with the eastern edge running just to the east of the lakes. I-5 typically constitutes the western edge, except for a small strip to the west of I-5 in the northern part of the sub-basin. This small strip may have originally been a tributary to the West Fork but has been rerouted to the East Fork by commercial development or freeway construction. Generally, the East Fork sub-basin is less developed than the West Fork sub-basin, although significant residential development has occurred in the northern portion of the East Fork sub-basin in the last ten years. South of SR 161, the East Fork flows in a narrow ravine which affords the stream some protection from surrounding land uses. An abandoned railroad grade follows the ravine. The Creek flows about 2,000 feet before entering the city of Milton near 7th Avenue. After crossing under 5th Avenue, the East Fork flows through a broad floodplain with extensive commercial development, then joins the West Fork in Spring Valley. The lower main stem of the Hylebos begins at the confluence of the West and East forks on the Puyallup Valley floor. The lower stem flows approximately 1000 feet before crossing back into unincorporated Pierce County.

Surprise Lake, located in the city of Milton, is another significant tributary to the mainstem. After crossing under Freeman Road, the Surprise Lake tributary is highly altered and channelized, following man-made agricultural and development drainage pathways that have been in-place for many years. The city of Fife is currently proposing to construct a new park facility with ball fields (Pacific National Soccer Park), along the Surprise Lake tributary just to the east of I-5. After crossing under I-5, the Surprise Lake tributary joins the Hylebos where the lower mainstem turns northwest and crosses under SR 99. The lower mainstem then flows along the very northern edge of the Puyallup Valley floor, following very closely along the base of Fife Heights, the hillside on the north side of the valley. This portion of the mainstem also receives lateral inflows from tributary areas located within the city of Fife on the west.

The stormwater system in the unincorporated study area portion of the Hylebos Basin consists of pipes and channels mainly in the Fife Heights area. According to Pierce County GIS, there are at least 5 storm drain outfalls that discharge directly to Hylebos Creek. Drainage problems in the Hylebos Creek study area are typically the result of natural drainage paths being filled or erosion due to increased runoff from development. Channel erosion is evident in the ravines draining Fife Heights.

4.2.2 Floodplains and Wetlands

As shown on *Figure 4-7*, the Hylebos Basin has a large mapped 100-year floodplain associated with the lower Hylebos, downstream of the confluence of the West and East Fork. Flood hazard areas are currently being reevaluated by FEMA. Mapped flood hazard areas may be expanded to include more lands within the incorporated Pierce County area of the Basin. County wetland inventory maps show one large "Category 2" wetland (~ 64 acres) which correlates to the floodplain area and eight uncategorized wetlands (~15 acres) (*Figure 4-8*). The categories represented on the figure were assigned pursuant to Pierce County *Critical Area Regulations* that were effective until March 1, 2005. A "Category 2" wetland under that system was typically a larger wetland with significant habitat and diversity of vegetation classes. If the wetland is re-evaluated under current rating criteria that category may change. Current rating criteria for wetlands are contained within *Section 18E.30.70, Appendix A of Pierce County Code Title 18E* and the *Washington State Wetland Rating System for Western Washington*, revised April 2004 (Ecology Publication #04-06-025. The wetland inventory does not contain all wetlands within Pierce County; there may be additional wetlands in the Basin that are not yet mapped.

4.2.3 Geology and Soils

The geology of Fife Heights and the lower Hylebos Basin is similar to the geology of the Browns-Dash Point Basin discussed above with the addition of alluvial lowlands in the lower Hylebos Basin. The geology of the Fife Heights upland area is the product of successive glacial and interglacial episodes which deposited hundreds to thousands of feet of unconsolidated materials on the underlying bedrock. The surficial geology is dominated by deposits from the most recent glacial episode, the Vashon stage of the Frazier glaciation. As described earlier, three types of Vashon glacial deposits are present: till, outwash, and lacustrine.

The alluvial lowland region is part of the northern fringe of the valley of the lower Puyallup River mainstem. The valley is filled with floodplain deposits consisting of coarse to fine alluvium, peat and volcanic mudflows. Due to the relatively remote location of the lowland region in relation to the Puyallup River, floodplain sediments that have accumulated during the past 500 years are predominantly fine textured over bank deposits of silts and clays. Not all alluvial materials in the lowland region originated from the Puyallup River. Local deltaic deposits consisting of eroded glacial materials have accumulated at locations where Hylebos Creek and its tributaries descend from the upland areas onto the valley floor.

Figure 4-9 shows the soil types of the area which affect infiltration rates, potential for erosion and slope stability.

The soils in the study area are part of two general associations identified by the Soil Conservation Service:

- **Alderwood-Everett Association** - consisting primarily of soils formed in glacial till and glacial outwash on uplands; and
- **Puyallup-Sultan Association** - consisting of nearly level soils formed in alluvium on floodplains.

Alderwood-Everett Association soils were discussed above in the description of Browns-Dash Point geology and soils. Soils of the Puyallup-Sultan Association which occupy the lowland portions of the Hylebos study area include the Sultan, Puget, and Semiahmoo series. Due to their level slope and slow permeability, nearly all of the soils present in the lowland region exhibit poor drainage characteristics and are classified as hydric by the Natural Resources Conservation Service (formerly Soil Conservation Services).

The western and southern portions of the lowland region are dominated by Sultan soils consisting of stratified silty clay loam, silt loam, fine sandy loam, and fine sand. Sultan soils are formed in over bank floodplain deposits. A seasonal water table forms in this soil at depths of less than two feet from the ground surface. Puget soils are similar in nature to soils of the Sultan series, but have a higher clay content and slower permeability resulting in a seasonal water table forming within a foot of the ground surface.

The eastern portion of the lowland region, the area between the Fife Heights upland and the Milton upland, is occupied primarily by Semiahmoo soils. The Semiahmoo series consists of soils formed in decaying vegetation, primarily reed canary grass and sedges. These hystic soils (high organic content, saturated for part of the growing season) consist primarily of muck with minor amounts of peat and clay. Semiahmoo soils are subject to frequent flooding and are saturated during substantial portions of the year.

4.2.4 Zoning and Land Use

The Hylebos Basin study area is located within the Pierce County *Urban Growth Area*. The study area is zoned primarily single family residential with small areas of mixed use and commercial activity as shown in *Figure 4-10*. Actual land use is approximately 57 percent residential (*Table 4-3* and *Figure 4-11*).

Table 4-3
Existing Land Use – Hylebos Basin

Existing Land Use	Area (acres)	Percent of Study Area
Commercial/Industrial	41.6	5.0
Open Spaces/Resource Lands	18.9	2.2
Public Places/Religious Centers	4.3	0.5
Residential	479.1	57.1
Transportation	8.2	1.0
Vacant/Undefined	286.5	34.2

The Fife Heights area has a number of larger tracts of land that are not yet developed to full zoning density. Portions of the undeveloped area include steep slopes, streams and other environmental constraints that could preclude their development. *Figure 4-12* is a map of buildable lands in the Hylebos study area (*Pierce County Buildable Lands Report, 2002*).

As can be seen from the map, approximately 58 percent of the study area is vacant or underdeveloped. See *Table 4-4*. Using the assumptions developed for the *2002 Buildable Lands Report* (*Table 6* and *Table 8* of the Report), of the remaining developable land area, only 40% is considered available for development, or a total of 195 acres. The rest is unavailable due to constraints such as critical areas, road and right of way construction, and public facilities. Excerpts from the *2002 Buildable Lands Report* are contained within *Appendix D.*

Table 4-4
Buildable Land Areas – Hylebos Basin

Land Development Designation	Area (acres)	Percent of Study Area
Vacant	248.5	29.6
Underdeveloped	238.8	28.4
Redevelopable	53.9	6.4
Developed	299.0	35.6

The County expects to see continued residential construction activity in the Fife Heights area as the study area builds out. According to 2000 census data, the population in the study area (which was calculated within unincorporated Pierce County only) is 1894. In 2004, the population was estimated to be 2,009 or an approximately 6% increase (1.5% per year). According to estimates made by Pierce County Public Works and Utilities staff as part of the *Traffic Fee Impact Study* in Spring 2005, the population in the study is projected to increase to 2,869 by the year 2025 Shawn Phelps, personal communication) or an approximately 43% increase over a 21-year period (2% increase annually). The area is projected to increase from a total of 806 households in 2004 to 1,298 households in 2025.

Residential development in the Basin tends to be on septic systems. Sewer service in the study area is largely limited to parcels along Pacific Highway South, as shown on *Figure 4-13*.

4.3 SUB-BASIN BOUNDARIES

Within each major basin study area, stream sub-basins were defined to facilitate data management and analysis. For example, projects are numbered according to their sub-basin. Sub-basins were delineated using topography information contained in the Pierce County *Geographical Information System* (GIS). Due to data limitations, the topography was simplified from 2-foot contour lines to 10-foot contour lines. This simplification resulted in a quicker process for sub-basin delineation and was considered appropriate for a general overview of the basin study areas.

Sub-basin identifiers were created by combining the initials for a tributary (e.g., West Hylebos) with a unique digit. For example, the lowest sub-basin of the West Hylebos branch is identified as WH1. Sub-basins were defined for stream reaches whose boundaries are wholly or partially contained within the study area boundaries (i.e., unincorporated Pierce County).

Sub-basin boundaries are shown on *Figures 4-14* and *4-15*, as can be seen from the figures, many sub-basins are not wholly contained within unincorporated Pierce County, and cross jurisdiction boundaries. As a result, problems or issues that are located in unincorporated Pierce County may actually be related to runoff or flow from upstream jurisdictions. This issue is discussed further in *Chapters 5* and *6*.

4.4 STREAM HABITAT

Although the scope of this project did not include field surveys of streams, existing data sources were used to characterize likely stream habitat conditions in the planning study areas. The existing data was then used to classify the streams. Stream classification is useful for the planning process, because it provides a logical basis for management measures such as stream buffers or restoration efforts. The remainder of this section summarizes known stream characteristics and then classifies streams according to methodologies developed by the State of Washington Department of Natural Resources (DNR) and R2 Resource Consultants.

4.4.1 Stream Characteristics

Table 4-5 below summarizes information for each stream reach. The table presents stream gradients, channel type, and flow regime. This information is useful in determining whether the stream is capable of providing fish habitat. Channel types describe the physical structure of a given length of stream, whereas flow regime describes whether the stream flows year round,

seasonally, or only after storms. The terms used in the table for channel type and flow regime are defined in the glossary at the end of this plan.

Table 4-5 also presents available fisheries information. The primary source of fisheries information was the Washington State Department of Fish and Wildlife (WDFW) Salmonscape website (http://wdfw.wa.gov/mapping/salmonscape). According to WDFW, Salmonscape, "merges fish and habitat data collected by state, federal, tribal and local biologists and presents it in an integrated system that can be readily accessed by other agencies and citizens." WDFW does not provide specific data sources or dates for information provided on the website. Information was also obtained from the Washington State Department of Ecology's web site for WRIA 10 data (http://www.ecy.wa.gov/services/gis/maps/wria/number/wria10.htm).

Stream characteristics in *Table 4-5* are organized according to stream reaches. A stream reach is a length of stream with relatively uniform slope, channel type, and other characteristics, or with clearly demarcated upstream and downstream boundaries (e.g., major tributary junctions, slope changes, etc.). For this project, the planning team used reach boundaries developed by the DNR. Each stream reach is denoted with a unique identifier. The identifiers were created by appending a unique reach number to the sub-basin identifier. *Figure 4-14* shows sub-basin boundaries and stream reaches for the Browns-Dash Point Basin. *Figure 4-15* shows sub-basin boundaries and stream reaches for the Hylebos Basin.

Table 4-5
Stream Reach Characteristics

Stream Reach Identifier	Slope	Channel Type	Flow Regime*	Salmonid Presence	Notes
Browns Dash Point Basin					
BDP1-R1	3.7%	Moderate gradient contained	Perennial	Y	**WDFW Salmonscape:** Coho-Presence documented in King County reach, no data re: stock status
BDP1-R2	12.0%	High gradient contained	Intermittent	N	No record of salmonid presence, but within ¼ mile of salmonid bearing waters
BDP1-R3	6.0%	Moderate gradient contained	Intermittent	N	No record of salmonid presence, but within ¼ mile of salmonid bearing waters
BDP1-R4	3.4%	Moderate gradient contained	Intermittent	N	No record of salmonid presence
BDP1-R5	7.5%	High gradient contained	Intermittent	N	No record of salmonid presence

Table 4-5
Stream Reach Characteristics

Stream Reach Identifier	Slope	Channel Type	Flow Regime*	Salmonid Presence	Notes
BDP1-R6	9.7%	High gradient contained	Intermittent	N	No record of salmonid presence
BDP1-R7	8.6%	High gradient contained	Intermittent	N	No record of salmonid presence
BDP4-R1	11.3%	High gradient contained	Intermittent	N	No record of salmonid presence
BDP7-R1	19.7%	High gradient contained	Intermittent	N	No record of salmonid presence
BDP8-R1	14.1%	High gradient contained	Intermittent	N	No record of salmonid presence
Hylebos Basin					
LH1-R1	0.5%	Estuarine	Perennial	Y	**WDFW Salmonscape:** Coho-Presence documented, stock status: healthy (Ecology WRIA 10 GIS lists as "Depressed/Threatened") Fall Chinook-Presence documented, no data re: stock status Fall Chum-Presence documented, status unknown Pink-Presence presumed, no data re: status Winter Steelhead-Presence documented, status: migration
LH1-R2	3.5%	Palustrine	Perennial	Y	Same as LH1-R1
LH1-R3	0.0%	Palustrine	Perennial	Y	Same as LH1-R1
LH1-R4	0.0%	Palustrine	Perennial	Y	Same as LH1-R1
LH1-R5	33.3%	High gradient contained	Intermittent	N	No record of salmonid presence
LH1-R6	0.0%	Palustrine	Perennial	Y	Same as LH1-R1
LH1-R7	31.9%	High gradient contained	Intermittent	N	No record of salmonid presence
LH1-R8	0.0%	Palustrine	Perennial	Y	Same as LH1-R1

Table 4-5
Stream Reach Characteristics

Stream Reach Identifier	Slope	Channel Type	Flow Regime*	Salmonid Presence	Notes
LH1-R9	25.0%	High gradient contained	Intermittent	N	No record of salmonid presence
LH1-R10	0.0%	Palustrine	Perennial	Y	Same as LH1-R1
LH1-R11	0.0%	Palustrine	Perennial	Y	Same as LH1-R1
LH1-R12	18.3%	High gradient contained	Intermittent	N	No record of salmonid presence
LH1-R13	0.6%	Floodplain	Perennial	Y	Same as LH1-R1
LH1-R14	0.0%	Palustrine	Perennial	Y	Same as LH1-R1
LH1-R15	0.0%	Palustrine	Perennial	Y	Same as LH1-R1
LH1-R16	35%	High gradient contained	Intermittent	Y	No record of salmonid presence
SL1-R1	-0.1%	Palustrine	Perennial	Y	**WDFW Salmonscape:** Coho-No data re: presence documented, stock status: healthy (Ecology WRIA 10 GIS lists as "Depressed/Threatened") Winter Steelhead-No data re: presence, status: migration
SL1-R2	0.2%	Palustrine	Perennial	N	No record of salmonid presence
EH1-R1	1.5%	Floodplain	Perennial	Y	**WDFW Salmonscape:** Coho-Presence documented, stock status: healthy (Ecology WRIA 10 GIS lists as "Depressed/Threatened") Fall Chinook-Presence presumed, no data re: stock status Fall Chum-Presence documented, status unknown Pink-Presence presumed, no data re: status Winter Steelhead-Presence documented, status: migration

Table 4-5
Stream Reach Characteristics

Stream Reach Identifier	Slope	Channel Type	Flow Regime*	Salmonid Presence	Notes
WH1-R1	0.4%	Palustrine	Perennial	Y	**WDFW Salmonscape:** Coho-Spawning, stock status: healthy (Ecology WRIA 10 GIS lists as "Depressed/Threatened") Fall Chinook-Presence documented, no data re: stock status Fall Chum-Spawning, status unknown Pink-Presence presumed, no data re: status Winter Steelhead-Presence documented, status: migration

*Flow regime assessment based on assessment of existing data and maps.

4.4.2 Stream Reach Classification

Stream reaches in the study areas were classified according to the DNR's *Interim Water Typing System* (effective July 1, 2005), as defined in Section 222-16-030 of the Washington Administrative Code. The DNR developed the water typing process in 1975 to regulate forest practices that impact Washington's surface waters. DNR stream reach types are based on physical, biological, and human-use characteristics. Fish-bearing streams are classified as *Types 1*, *2*, or *3*. *Type 4* and *Type 5* streams are non fish-bearing. Water typing can facilitate better protection for fish and their habitats. For example, greater riparian buffer zones can be required on stream reaches with higher resource values. The DNR interim typing system for water bodies in forested regions is summarized below:

- ***Type 1***—Waters defined as "shorelines of the state" within their ordinary high water mark.
- ***Type 2***—Segments of perennially flowing natural waters that have a high fish, wildlife, or human use.
- ***Type 3***—Segments of perennially flowing natural waters that have a moderate-to-slight fish, wildlife, or human use.
- ***Type 4***—Perennially or intermittently flowing natural waters more than 2-feet wide between the ordinary high water marks and generally without significant fish, wildlife, or human uses.
- ***Type 5***—All other natural waters, including streams with or without well-defined channels, areas of perennial or intermittent seepage, ponds, natural sinks, and drainage ways with short periods of spring or storm runoff.
- ***Type 9***—Unclassified waters.

The stream reaches were also classified based on the water types enumerated in *Section 18E.40.060 of Title 18E of the Pierce County Development Regulations – Critical Areas*. The Pierce County stream typing system is based on an anticipated new DNR approach that will replace the interim approach described above.

The table below, from *PCC 18E.40.060*, summarizes the Pierce County stream typing system and associated required development buffers.

TABLE 18E.40.060. Buffer Requirements		
Water Type[1]	**Water Body Criteria**	**Buffer Width[2,4]**
Type F1	All segments of natural waters within the bankfull widths of defined channels or within lakes, ponds, or impoundments which provide habitat for or support any portion of the lifecycle of a critical fish species. Waters that are diverted for use by federal, state, tribal, or private fish hatcheries shall be considered to be Type F1 waters upstream from the point of diversion for 1,500 feet and tributaries if highly significant for protection of downstream water quality.	150 feet landward from the OHWM
Type F2	Type F1 water adjacent to a landslide hazard area as set forth in Chapter 18E.80.	150 feet landward from the OHWM or the minimum buffer distance required in Chapter 18E.80, whichever is greatest
Type N1	Perennial or seasonal non-fish bearing[3] natural waters within the bankfull widths of defined channels that are not Type F1 or F2 waters but are located within ¼ mile of the confluence with a Type F1 or F2 water.	115 feet landward from the OHWM
Type N2	Perennial or seasonal non-fish bearing[3] natural waters within bankfull width of defined channels that are not Type F1 or F2 waters and are either located more than ¼ mile upstream from the confluence with a Type F1 or F2 water or are not connected to a Type F1 or F2 water.	65 feet landward from the OHWM
Type N3	Lakes or ponds that do not support any critical fish species[3]	35 feet landward from the OHWM

[1] Water types are approximately based on the following: Type F1 (Type 1-3, Type 4 if greater than 2 feet and less than 20 percent grade unless documented as non-fish bearing by Federal or State agencies or Tribes), Type N1 (Type 4 if less than 2 feet and greater than 20 percent grade unless documented as fish bearing by Federal or State agencies or Tribes), Type N2 (Type 5 waters and those waters not connected to another water type). The new nomenclature anticipates the new classification system established in WAC 222-16-030 and 031. Water types are mapped in the Pierce County Critical Areas Atlas: Fish and Wildlife Habitat Areas-Stream Typing Maps and Fish and Wildlife Habitat Areas-Critical Fish Presence Maps.

[2] There may be wetlands associated with ponds or lakes that are regulated and which may have a required buffer greater than those listed in Table 18E.40.060, e.g., a lake with a 35-foot buffer requirement may have associated wetlands with 25-300 foot buffers.

[3] Fish species are those identified in Section 18E.40.020.

[4] Lake Tapps and Spanaway Lake are not subject to the buffering requirements shown above in Table 18E.40.060 of this Chapter.

Table 4-6 below defines the DNR and Pierce County water types for each of the reaches in the Hylebos Browns-Dash Point Basin, based on the definitions described above. The DNR stream types were obtained from the DNR and verified/updated during the planning process. The Pierce County water types were ascertained based on comparison with the DNR water types and review of physical stream characteristics, such as gradient.

Table 4-6
Stream Reach Water Types

Stream Reach Identifier	Salmonid Presence	Notes	DNR Interim Water Type	Pierce County Water Type
BDP1-R1	Y	**WDFW Salmonscape:** Coho-Presence documented in King County reach, no data re: stock status	4	F1
BDP1-R2	N	No record of salmonid presence	5	N2[2]
BDP1-R3	N	No record of salmonid presence	5	N2[2]
BDP1-R4	N	No record of salmonid presence	5*	N2
BDP1-R5	N	No record of salmonid presence	5*	N2
BDP1-R6	N	No record of salmonid presence	5*	N2
BDP1-R7	N	No record of salmonid presence	5*	N2
BDP4-R1	N	No record of salmonid presence	5	N2
BDP7-R1	N	No record of salmonid presence	9	N2
BDP8-R1	N	No record of salmonid presence	5	N2
LH1-R1	Y	**WDFW Salmonscape:** Coho-Presence documented, stock status: healthy (Ecology WRIA 10 GIS lists as "Depressed/Threatened") Fall Chinook-Presence documented, no data re: stock status Fall Chum-Presence documented, status unknown Pink-Presence presumed, no data re: status Winter Steelhead-Presence documented, status: migration	3	F1
LH1-R2	Y	Same as LH1-R1	3**	F1
LH1-R3	Y	Same as LH1-R1	3	F1
LH1-R4	Y	Same as LH1-R1	3	F1
LH1-R5	N	No record of salmonid presence	9	N1

[2] But within ¼ mile of salmonid bearing waters

Table 4-6
Stream Reach Water Types

Stream Reach Identifier	Salmonid Presence	Notes	DNR Interim Water Type	Pierce County Water Type
LH1-R6	Y	Same as LH1-R1	3	F1
LH1-R7	N	No record of salmonid presence	9	N1
LH1-R8	Y	Same as LH1-R1	3	F1
LH1-R9	N	No record of salmonid presence	9	N1
LH1-R10	Y	Same as LH1-R1	3	F1
LH1-R11	Y	Same as LH1-R1	3	F1
LH1-R12	N	No record of salmonid presence	9	N1
LH1-R13	Y	Same as LH1-R1	3	F1
LH1-R14	Y	Same as LH1-R1	3	F1
LH1-R15	Y	Same as LH1-R1	3	F1
LH1-R16	Y	No record of salmonid presence	9	N1
SL1-R1	Y	**WDFW Salmonscape:** Coho-No data re: presence documented, stock status: healthy (Ecology WRIA 10 GIS lists as "Depressed/Threatened") Winter Steelhead-No data re: presence, status: migration	3	F1
SL1-R2	N	No record of salmonid presence	4	N1
EH1-R1	Y	**WDFW Salmonscape:** Coho-Presence documented, stock status: healthy (Ecology WRIA 10 GIS lists as "Depressed/Threatened") Fall Chinook-Presence presumed, no data re: stock status Fall Chum-Presence documented, status unknown Pink-Presence presumed, no data re: status Winter Steelhead-Presence documented, status: migration	3	F1
WH1-R1	Y	**WDFW Salmonscape:** Coho-Spawning, stock status: healthy (Ecology WRIA 10 GIS lists as "Depressed/Threatened") Fall Chinook-Presence documented, no data re: stock status Fall Chum-Spawning, status unknown Pink-Presence presumed, no data re: status Winter Steelhead-Presence documented, status: migration	3	F1

* DNR classified as 9 but should be 5 since upstream of a 5 segment
** DNR classified as 4, should be 3, since located between two type 3 segments

4.4.3 Urban Stream Baseline Evaluation Method (USBEM) Habitat Suitability

Available stream habitat information was also evaluated within the context of the "Pre-Field Classification Phase" of the *Urban Stream Baseline Evaluation Method* (USBEM) developed under the *Tri-County Urban Issues ESA Study* (R2 Resource Consultants, 2000). This technique does not involve field visits or stream walks, but instead is based on review of aerial photos, blockage databases, and GIS data. The intent of this Phase is to identify whether potential stream reaches provide highly suitable, secondary, or negligible fish habitat. Those reaches that provide highly suitable or secondary habitat would then be considered for more detailed field surveys to better ascertain existing habitat quality and identify potential conservation or restoration opportunities.

As *Table 4-7* below shows, most of the stream reaches in the Browns-Dash Point study area (with the exception of BDP1-R1, R3 and R5) were categorized as of negligible suitability for habitat due to steep channel gradients and lack of adequate base flows (King County, 1990). Another factor in habitat suitability is the degree of watershed and channel alteration. In general, due to extensive development and channel alterations, including straightening and confinement from the floodplain, the reaches in the Hylebos Creek study area were determined to have a "high" level of alteration. Therefore, Hylebos Creek study area reaches known to have presumed or documented salmonid presence were categorized as being as being of "secondary" suitability. Although the lower Hylebos may have provided excellent habitat historically, these reaches are now primarily used by salmonids migrating to spawning grounds in the upper reaches of the West and East Branches (King County, 1990).

Table 4-7
USBEM Phase 1 Stream Reach Habitat Suitability

Stream Reach Identifier	Chinook	Coho	Chum	Pink	Steelhead	Sea-Run Cutthroat	Bull Trout
Browns-Dash Point Basin							
BDP1-R1	Secondary	Secondary	Negligible	Negligible	Secondary	Secondary	Secondary
BDP1-R2	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
BDP1-R3	Secondary	Secondary	Negligible	Negligible	Secondary	Secondary	Secondary
BDP1-R4	Not in Pierce County						
BDP1-R5	Negligible	Negligible	Negligible	Negligible	Secondary	Negligible	Secondary
BDP1-R6	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
BDP1-R7	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
BDP4-R1	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
BDP7-R1	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
BDP8-R1	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

Table 4-7
USBEM Phase 1 Stream Reach Habitat Suitability

Stream Reach Identifier	Chinook	Coho	Chum	Pink	Steelhead	Sea-Run Cutthroat	Bull Trout
Hylebos Basin							
LH1-R1	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
LH1-R2	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
LH1-R3	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
LH1-R4	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
LH1-R5	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
LH1-R6	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
LH1-R7	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
LH1-R8	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
LH1-R9	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
LH1-R10	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
LH1-R11	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
LH1-R12	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
LH1-R13	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
LH1-R14	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
LH1-R15	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
LH1-R16	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
SL1-R2	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
EH1-R1	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
WH1-R1	**Outside study area**						

4.5 WATER QUALITY CHARACTERISTICS

Outer Commencement Bay is on the *Washington State Department of Ecology* (WDOE) *303(d) List* for fecal coliform, and establishment of a "Total Maximum Daily Load" (TMDL) has been recommended. *Figure 4-16* illustrates the location wherein samples were collected that resulted in the 303(d) listing (WDOE 2004). Also, in 1983, the U.S. *Environmental Protection Agency* (EPA) declared Commencement Bay nearshore tide flats a "Superfund" clean-up site. The Hylebos waterway is designated as a part of the larger site targeted for environmental cleanup under Superfund law. In addition to the historic Superfund issues, segments of the Hylebos Creek mainstem and the West Fork just upstream of the Pierce County line, are listed for fecal coliform violations on the *303(d) List*, with TMDLs potentially pending.

Little additional information is available regarding water quality in the basin planning area. The most recent data available is from a 1991-1993 study conducted by the *Tacoma-Pierce County Health Department* (TPCHD). The TPCHD study focused on reaches of the Hylebos located in Pierce County, and involved sampling at the mouths of outfalls and tributaries to Hylebos Creek, and on Hylebos Creek downstream from those inflows. About 57 percent of the 262 samples collected at 99 different sampling stations exceeded "action limits." These were primarily for copper, zinc, lead, and arsenic. A few samples exceeded the action limits for oil and grease. Only two samples were analyzed for fecal coliform bacteria, and both exceeded the state standards. The observed concentrations for these parameters are within the range typically observed in runoff from residential and commercial areas in the Northwest. However, the elevated arsenic may reflect aerial deposition from the former ASARCO smelter on Ruston Way

Arsenic concentrations in local soils were studied in the *Pierce County Footprint Study* as part of the *Tacoma Smelter Plume Project*. *Figure 4-17* shows the maximum arsenic per property and wind distribution patterns. *Figures 4-18* and *4-19* show the summary of lead results and of arsenic results, respectively. As shown in these figures, the concentrations are lower in the Hylebos Browns-Dash Point Basin. Although the arsenic contamination in the area has not been identified as affecting the quality of runoff, the arsenic contamination in the area could affect water quality from trench dewatering and handling of excavated materials.

Another potential source of arsenic pollution is an old wood waste site near the Surprise Lake tributary to Hylebos Creek, just east of I-5. The site is in unincorporated Pierce County, and has been the subject of a WDOE remediation effort. It has been capped, and a monitoring system has been installed. The site is a potential source of arsenic into both Hylebos Creek and the Surprise Lake tributary. It continues to be monitored by WDOE.

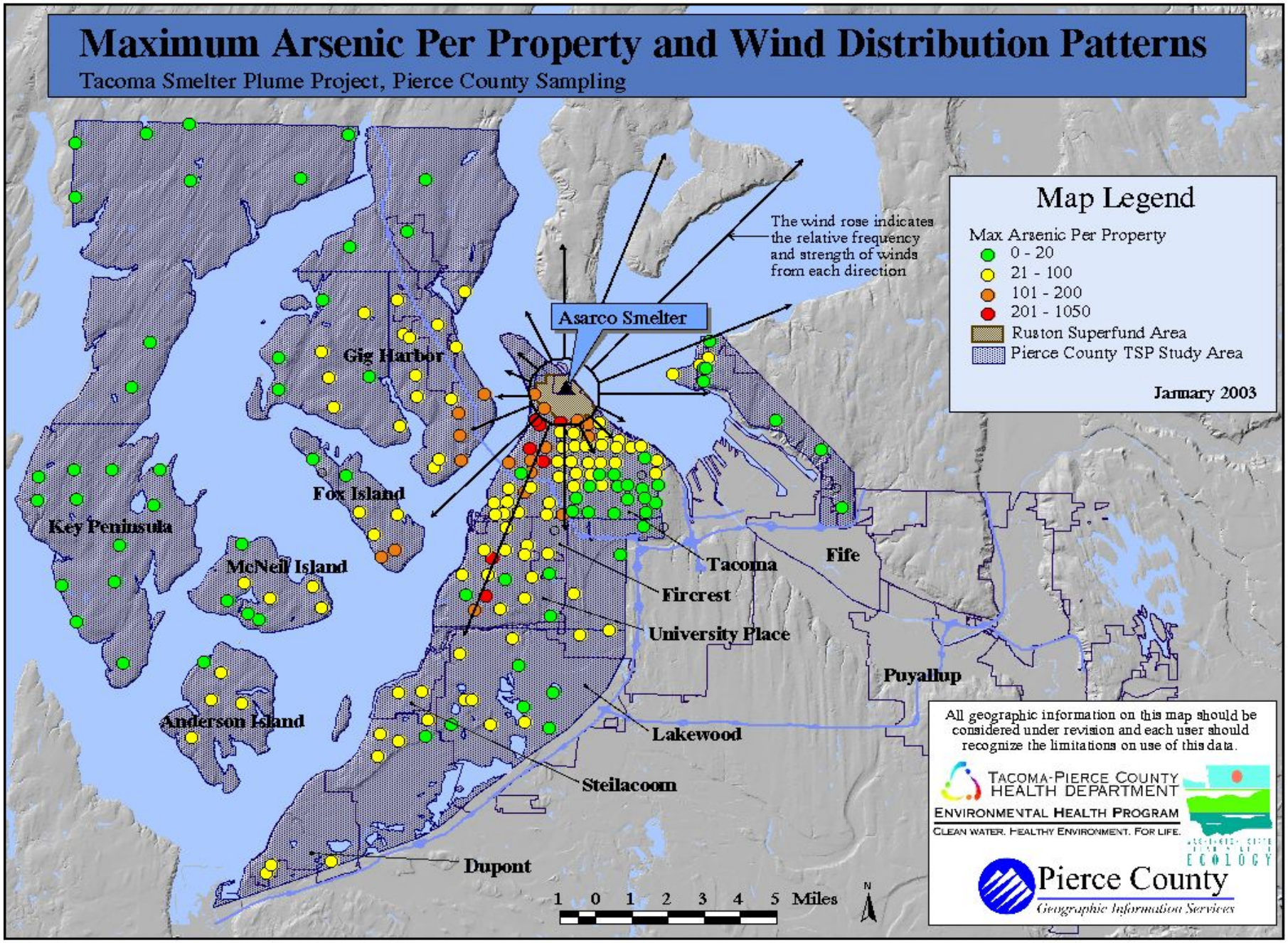

Figure 4-17 Maximum Arsenic Per Property and Wind Distribution Patterns

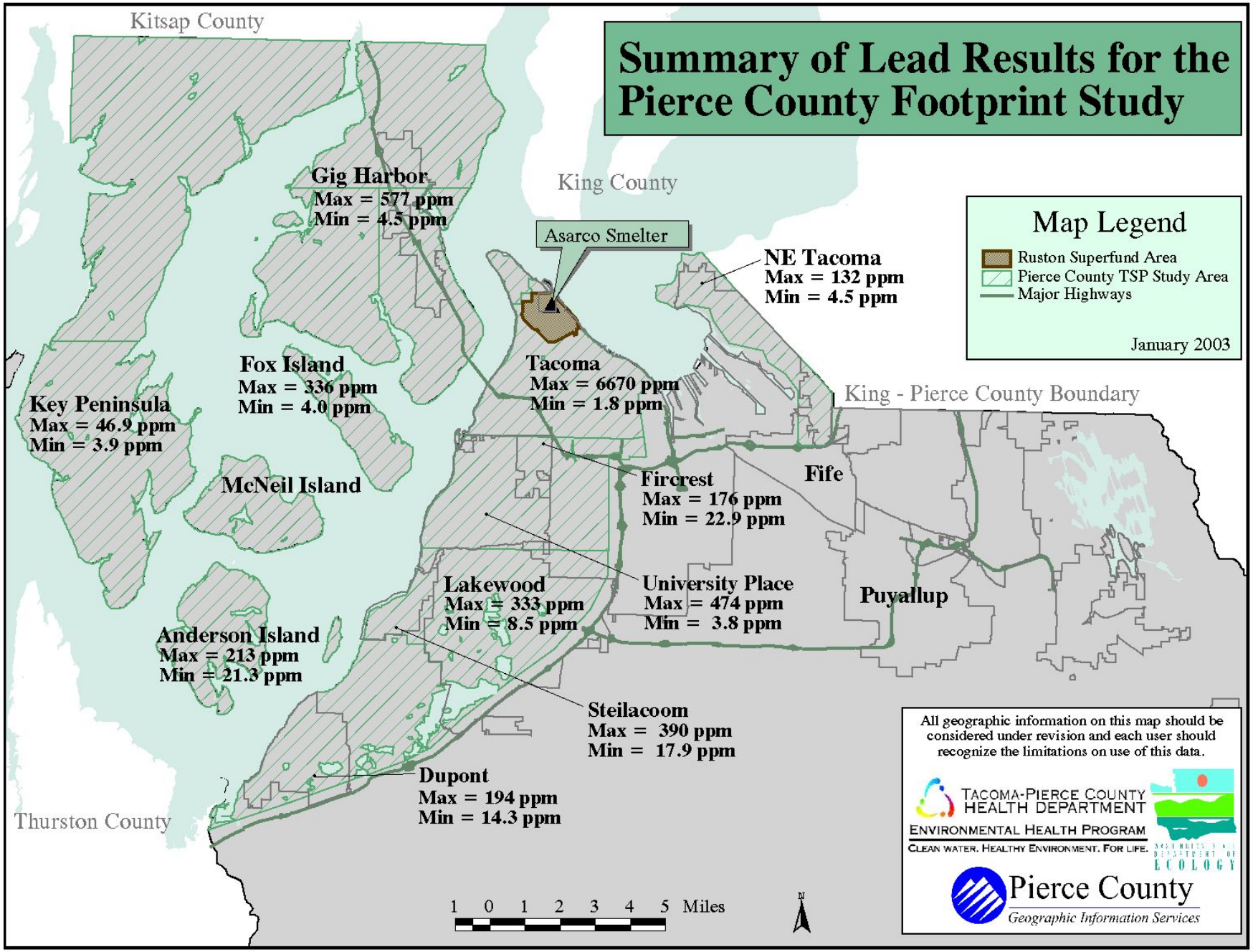

Figure 4-18 Summary of Lead Results for the Pierce County Footprint Study

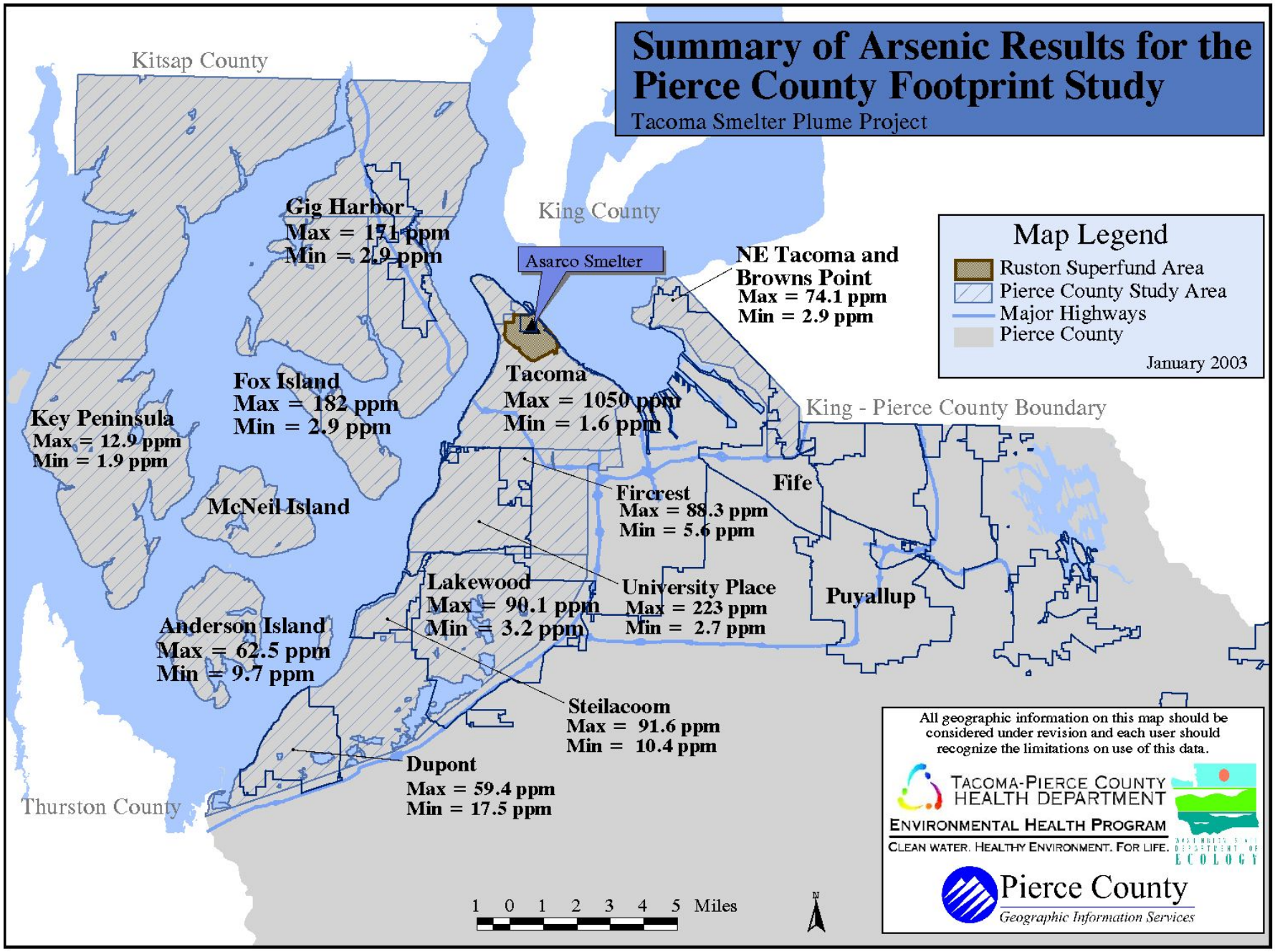

Figure 4-19 Summary of Arsenic Results for the Pierce County Study

CHAPTER FIVE
Problem Investigation, Characterization, and Screening

This chapter describes storm drainage, surface water quality, and stream habitat problems identified in the Browns-Dash Point and Hylebos basins during the preliminary phases of basin plan development. Problem identification was based on the information collection and stakeholder involvement activities described in *Chapters Three* and *Four*. Problem solutions are presented in *Chapter Seven*.

Potential problem sites were identified by Water Programs through review of existing citizen concerns (as recorded in the *Service Response System* (SRS) database) or by County field staff. During public meetings, additional problem sites were identified.

Planning team members have made several site visits to the Hylebos Browns-Dash Point Basin to conduct preliminary evaluations of all identified drainage problems. These preliminary evaluations were completed to determine possible solutions, and a final list of problems to be further evaluated was compiled.

5.1 STORMWATER DRAINAGE, EROSION, & FLOODING PROBLEMS

Problems observed included flooding caused by the absence of drainage facilities, undersized facilities, inadequate maintenance of existing facilities, and erosion of natural drainage channels by increased peak flows and durations. These problems are typical of areas built prior to comprehensive site development stormwater regulations and areas that contain small projects built incrementally without master drainage planning. Many of the older site drainage improvements were sized with limited hydrologic and hydraulic analysis which may not have anticipated upstream development or flows from other jurisdictions. These would not meet current design standards. Some flooding has resulted from access constraints limiting Water Programs' ability to conduct maintenance activities. These constraints include lack of easements, or the inability to access easements due to encroachment by adjoining property owners.

Table 5-1 below summarizes the sites visited and the concern or problem identified.

Table 5-1
Preliminary List of Problem Sites

Basin	Site ID	Nearest Street	Concern at Site
Browns-Dash Point	BDP-1	Water Street NE	Possible erosion
	BDP-2	Spring Street NE	Downcutting/channel incision
	BDP-3	Dry Gulch and Varco Road	Insufficient channel and pipe capacity
	BDP-4	Caledonia Road	Seasonal basement flooding
	BDP-5	Hyada Drainage	Possible erosion and channel incision
	BDP-6	Tok-A-Lou Avenue NE	Insufficient inlet and pipe capacity
	BDP-7	Wa-Tau-Ga Avenue NE	Insufficient inlet and pipe capacity; flooding out of catch basin at grade break
	BDP-7A	Layman Terrace	Insufficient inlet and pipe capacity
	BDP-8	Northwood Avenue NE	Insufficient inlet and pipe capacity
	BDP-9	Tok-A-Lou Avenue NE near Ton-A-Wan-Da Avenue	Broken outfall pipe and erosion
	BDP-10	Hyada Blvd. & La Hal Da Avenue NE	Insufficient inlet and pipe capacity
	BDP-11	Hyada & Wan-I-Da Avenue	Insufficient pipe capacity
Hylebos	H-1	8th Street E & 66th Street	Insufficient channel and culvert capacity
	H-2	66th Avenue NE	Insufficient inlet and pipe capacity; downcutting/ channel incision
	H-3	9th Street Court NE	Insufficient inlet and pipe capacity
	H-4	Hylebos Creek at 70th Avenue	Insufficient channel capacity
	H-5	Freeman Road East and 25th (City of Milton)	Insufficient pipe/culvert capacity; possibly below flood plain elevation
	H-6	67th Avenue and Hylebos Creek	Insufficient channel capacity due to high tide/storms and bridge low chord

5.1.1 Browns-Dash Point Basin

Figure 5-1 shows the locations of problem sites identified in the unincorporated Pierce County portions of the Browns-Dash Point Basin. Most of the problem sites are in residential areas at or near the bottom of steep slopes, at the downstream end of storm drainage systems. The remainder of this section provides descriptions of each problem.

Site BDP-1 – Water Street Northeast

Stormwater discharging from Water Street Northeast onto the beach contributes to erosion problems. In the past, there has been beach erosion due to the erosive forces of the discharge. The area drains from East Side Drive NE and many of the surrounding homes down Water Street Northeast. There are few drainage ditches and pipes until the end of Water Street Northeast. Runoff flows down the slopes of surrounding properties and along the street. Once stormwater flow reaches the end of Water Street Northeast, runoff enters the drainage system through two catch basins connected to a 12-inch polyvinyl chloride (PVC) pipe. The pipe drains to Puget Sound, where it daylights through a rock bulkhead and discharges onto the beach. (*Figure 5-2*)

Site BDP-2 – Spring Street NE

Water exiting a stormwater pipe into a gulch has caused downcutting and erosion. A stormwater pipe and open ditch system convey stormwater from a portion of a residential neighborhood. The stormwater is conveyed through an 18-inch concrete pipe under Spring Street NE and discharges into a seasonal creek, which eventually flows into Dash Point State Park. The erosive stormwater flows have incised approximately 100 linear feet of channel where the pipe daylights after crossing under Spring Street. In addition to the damage in the immediate problem area, the erosion can lead to high downstream levels of total suspended solids and sedimentation during storm events. Brush and other debris washed downstream could block the culvert beneath the bridge. Trash and yard waste dumping are a potential water quality and education problem as discussed further in *Section 5.2.2 – Water Quality Issues*, and *Section 7.2 – Programmatic Recommendations*. (*Figure 5-3*)

Site BDP-3 – Dry Gulch and Varco Road

There are several issues associated with this stormwater system:

A carport above Varco Road floods during storm events. Most of the runoff is from the plateau sub-basins east of Varco Road that are outside of unincorporated Pierce County. The upper plateau tributary areas are within the City of Tacoma and include Browns-Point Elementary School and other residential development. Over the last eight years, there have been two complaints of a carport flooding. Stormwater runoff from the plateau flows through culverts at the intersection of 51st Street and Harbor View Drive, into a channel that cuts through private property and runs adjacent to the carport of concern. Below the carport, the drainage enters the ditch system along Varco Road that discharges into Dry Gulch. (*Figure 5-4*)

A second concern is erosion caused by stormwater flowing from Varco Road into Dry Gulch. From Varco Road to the stream bed in Dry Gulch, the drainage drops more than 100 vertical feet over a horizontal distance of approximately 250 feet. The flows entrain sediment, which is a water quality concern. In addition, large debris that moves down Dry Gulch creates a maintenance problem and may block the Dry Gulch inlet/trash rack in the ravine below the East Marine Drive bridge.

A third concern is flooding of private property at the bottom of Dry Gulch on Commencement Bay. Below the East Marine Drive bridge, ecology blocks and a large trash rack have been placed in the ravine to stabilize the stream banks and collect debris before flow enters a 42-inch underground pipe, which conveys runoff past a large residence and into Commencement Bay. If the trash rack is obstructed, flows will overtop the culvert and be intercepted by a secondary inlet structure. The secondary inlet structure consists of a 6-foot diameter trash rack and has a rock containment berm to reduce overflows. If stormwater overtops the secondary overflow structure, the residential property downstream at the mouth of the gulch may be flooded. Flooding of the residence occurred in 1990 and 1996.

It is not clear if the flooding of the residence at the mouth of Dry Gulch is the result of debris clogging the trash rack, an undersized inlet, or undersized conveyance pipe. Further analysis is needed to determine if capital improvements are needed. Also, much the system at this location was constructed by the City of Tacoma, and the maintenance agreements are therefore granted to the City. Any proposed County work at this problem site would require coordination with the City.

Site BDP-4 – Caledonia Road

Homeowners have experienced seasonal flooding. Water Programs has received calls from homeowners along Caledonia Road down to East Side Drive NE who experience basement flooding nearly every winter, when the groundwater table is high. Caledonia Road is downslope of Varco Road and appears to be downgradient of any groundwater flows crossing Varco Road. Bluff seepage is common in this area. Stormwater management activities that include infiltration upslope of Caledonia Road could affect these homes. (*Figure 5-4*)

Site BDP-5 – Hyada Drainage

Erosion, channel incision and tidal activity created problems in the area of Hyada Blvd. NE and 9th Avenue NE. Surface water is conveyed north from Wau-Tau-Ga Avenue NE through a conveyance system of drainage ditches and culverts. Flow enters an 18-inch corrugated metal pipe that discharges into a natural, open gully. Continued discharge into the gully has resulted in substantial erosion along the channel. Flow proceeds from the channel through an 18-inch pipe under Hyada Blvd., under a residence, and discharges onto the beach. (*Figure 5-5*)

Periodic blockages have occurred at both the inlet and outlet. The inlet was obstructed by debris and the outfall was obstructed by tidal action and debris. The blockages contributed to crawl space flooding on private property. The blockage of the inlet pipe also resulted in water impoundment on the south side of Hyada Blvd. The road acts as a dam and water depths greater than 10 feet had been observed by residents in the area. Prolonged saturation would result in the structural failure of Hyada Blvd. and the loss of the homes and a sewer pump station downstream. There is evidence that an unauthorized drainage pipe also contributes to the flooding.

In 2000, rock rip rap was placed in the gully and appears to have stabilized the channel. A structure was placed on the inlet to protect against blockage by debris. A small works project in 2001 involved the installation of a new outlet structure and energy dissipater on the beach. The outfall has a standpipe that allows stormwater to discharge during high tides.

Site BDP-6 – Tok-A-Lou Avenue NE

In the past, road drainage caused bluff erosion and property damage in the Tok-A-Lou Avenue area. Some stormwater would flow past the catch basin and across the lawn between the two houses. Both the overland flow and discharge from the outfall pipe near the top of the bluff were eroding the steep bluff. The erosion damaged landscaping and could ultimately have impacted the residences. (*Figure 5-6*)

Water Programs addressed the overland flow problem by installing a small asphalt berm to contain and capture the street runoff. Erosion from the stormwater outfall was reduced by the installation of a plastic coated canvas sleeve to the end of the pipe which extends over the bluff and down toward the beach. The canvas sleeve extends down the bluff to approximately 5 feet above the beach and is anchored to the bluff with rebar hoops driven into the bank. The installation is considered temporary and should be replaced by a more permanent outfall.

Design of any new structures would need to address the issue of encroachment on the drainage pipe easement between the two houses by a building addition and a fence.

Site BDP-7 – Wa-Tau-Ga Avenue NE

A cul-de-sac at the end of Wa-Tau-Ga Avenue floods. Stormwater is collected along Granville Avenue NE and is conveyed by a tightline through private property to Wa-Tau-Ga Avenue. The piped flow discharges into a ditch along the east side of Wa-Tau-Ga Avenue. An asphalt/concrete berm also diverts sheet flow from the street into the ditch. At the south end of the ditch, the flow enters a culvert and is piped under the cul-de-sac, down the bluff, and out to Commencement Bay. Street runoff and any seepage that is not collected by the ditch enters the pipe system via two catch basins in the cul-de-sac. The downstream end of the pipe is a 12-inch concrete pipe that is routed beneath an old wood shed before discharging to Commencement Bay. The end of the pipe is partially obstructed by driftwood and other debris. Runoff, from the cul-de-sac and ditch overflow that bypasses the catch basins in the pavement, flows off the pavement, around the sanitary sewer pump station at the end of the cul-de-sac and down the steep slope to the shoreline. There is some erosion around the pump station and it is settling. It is not clear that the settlement of the pump station is due to surface water flows. It is possible that the movement of the station is due to consolidation of fill materials or deeper movement of the supporting soils. (*Figure 5-7*)

Several issues appear to be contributing to flooding of the Wa-Tau-Ga cul-de-sac:

- The ditch along Wa-Tau-Ga Ave may not have enough conveyance capacity.
- Culverted sections of the ditch may need repair and/or greater capacity.
- Culvert inlets may need additional regular maintenance.
- Seepage and overland flow from Granville Avenue to Wa-Tau-Ga Avenue misses the ditch and flows out onto the street.
- The tightline conveying runoff from Granville Ave. through the private property may be undersized, with resulting overflows causing erosion and contributing to overland flow onto Wa-Tau-Ga Ave. The overland flow on Wa-Tau-Ga Ave. is causing flooding and erosion around the pump station.

Site BDP-7a – Layman Terrace

Two homes experience flooding at the end of Layman Terrace NE. Stormwater flows down Layman Terrace, across a vacant lot, and follows the existing slope to flood these homes during storm events. The flooding occurs as frequently as every five years. There is a privately owned and maintained stormwater system downstream of Water Programs ditch. It is undersized and does not appear to be adequately maintained. The system restricts the flow of stormwater causing it to back up and overflow the road. (*Figure 5-8*)

Site BDP-8 – Northwood Avenue NE

The system installed to drain a low lying area requires repairs to reduce the potential for flooding. Stormwater flows in excess of the existing conveyance system capacity could flow overland, behind homes in the Northwood area, prior to reaching the original flow path along the transmission line right of way. The overland flow could potentially damage the residences or improvements to the private properties. (*Figure 5-9*)

Most of the runoff is from drainage sub-basins outside of Pierce County. Drainage flowing from the northeast is primarily from King County and a pipe from across Northwood Avenue collects runoff from Pierce County. Although most of the runoff is from outside Pierce County, the problem has been caused by the development inside Pierce County. It appears that when the houses were built, a portion of the low area was filled, and the natural drainage outlet was blocked. Recently, Water Programs staff exposed an outlet pipe, which drains the low area through a pipe that is aligned through the backyards of the two private residences. Although Water Programs and Tacoma Water rebuilt a portion of this system in 2003/2004, further repairs are needed to replace a failing catch basin and a curved pipe alignment of the pipe.

Site BDP-9 – Tok-A-Lou Avenue NE near Ton-A-Wan-Da Avenue

An outfall to Commencement Bay requires repair. A 12-inch PVC culvert crossing Tok-A-Lou Avenue near Ton-A-Wan-Da Avenue transitions into a 12-inch concrete pipe that runs west between two residences into a catch basin near the top of the bluff. The 12-inch concrete pipe over the edge of the bluff is covered with ivy and is reported to be broken. Remnants of the pipe are visible beyond the toe of the slope along a concrete retaining wall that supports a house. The former outlet end remains encased in concrete, flush with the face of the concrete retaining wall. The property owner indicated that, during rainstorms, water flows out of the broken pipe on the slope and along the wall foundation causing erosion and potential damage to the foundation. (*Figure 5-10*)

Site BDP-10 – Hyada Blvd. & La Hal Da Avenue NE

Ditches are regularly overtopped and water floods the intersection and washes gravel and other sediment from the ditches out onto the pavement. Culverts collecting runoff at the intersection of Hyada Blvd. and La Hal Da Avenue NE are poorly configured. Runoff from Hyada Blvd. flows through a 12-inch concrete culvert east to the ditch on La Hal Da Avenue and then turns sharply northward into a 12-inch culvert flowing north on Hyada Blvd. which continues north toward the outfall. (*Figure 5-11*)

Site BDP-11 – Hyada & Wan-I-Da Avenue

Surface water from east on Hyada Blvd. floods Hyada Blvd. in the vicinity of an 18-inch crossing. The drainage system on Hyada Blvd. consists of a series of open ditches and 12-inch concrete culverts flowing northward on the east side of the street. When Hyada Blvd. turns east, drainage enters an 18-inch storm drain that crosses Hyada Blvd. and continues northward down on Wan-I-Da Avenue to an 18-inch outfall to Puget Sound. The 18-inch crossing and the outfall appear to be undersized. This problem is immediately downstream of the problem identified above as BDP-10. (*Figure 5-11*)

5.1.2 Hylebos Basin

Drainage, flooding, and erosion problems in the unincorporated Pierce County portions of the Hylebos Basin are typically related to increased runoff from development in the Fife Heights area or to floodplain filling along lower Hylebos Creek. *Figure 5-12* illustrates the problem site locations in the Hylebos Basin. The remainder of this section provides brief descriptions of each problem site.

The most significant flooding on lower Hylebos Creek occurs where the channel makes its turn to the northwest and comes close to and crosses under I-5 and Hwy 99. During the 1996 and 1997 flood events, floodwaters encroached into the outer lanes of I-5 at this location. At this location, Hylebos Creek is confined to a narrow channel lined with ecology blocks and is forced to make a series of sharp degree turns. East of I-5, large fields and some houses were flooded

during the 1996 and 1997 events. This flooding followed the Surprise Lake drainage path downstream to the confluence with the Hylebos main stem, west of I-5. At this location a new SR 167 interchange is proposed by Washington State Department of Transportation (WSDOT).

Proposed WSDOT improvements to SR 167 include construction of a four-lane freeway. The two general-purpose lanes in each direction and high occupancy vehicle lanes would extend SR 167 from its junction with SR 161 to SR 509. Access to the new facility would be provided at interchanges in key locations: SR 509, 54th Avenue – partial interchange, I-5, Valley Avenue East, and SR 161. Early right of way acquisitions began in 2001 and construction could begin in 2009-2010. The project would include significant riparian restoration for stormwater management in the Hylebos Creek areas in north Pierce County (www.wsdot.wa.gov/Projects/SR167/TacomaToEdgewood, July 13, 2005). Some of the problems discussed below lie in areas that would be affected by the SR 167 project.

Site H-1 – 8th Street East and 66th Street

A low portion of 8th Street floods during the wet season, whenever rainfall events occur after the ground is saturated. The flooded area of 8th Street is within a drainage basin that extends approximately 3,000 feet upslope of the roadway. Contour mapping suggests runoff from this tributary area used to flow unimpeded towards a gully south of 8th Street. However, construction of the roadway embankment and improvements to the adjacent properties appear to have blocked this natural flow path. Based on these observations, flooding most likely occurs when surface runoff in the uphill roadside ditch exceed the seepage rates through the roadway subgrade. When the uphill roadside ditch is overtopped, water sheet flows across the street and continues downslope toward a gully that forms the natural drainage path. A private driveway with a cross-culvert has been constructed across the upper end of the downslope gully. The capacity of this downstream culvert must be checked to confirm it has sufficient capacity to carry flows that may be increased due to any upstream improvements. (*Figure 5-13*)

Site H-2 – 66th Avenue NE

The main concern at this site is potential damage to residences below 1st Street Court NE and erosion adjacent to a residence on 66th Avenue NE . Flows from 1st Street Court NE are piped through a 12-inch concrete pipe which discharges down a steep slope. There is no defined channel at the discharge location and the outflow is eroding the hillside. The existing home and a new home under construction could be damaged by flooding and/or erosion. After flowing down the steep slope, stormwater flows down a side street to 66th Avenue. At 66th Avenue, the stormwater is collected in an open ditch and transported north to where it is conveyed under the street in an 18-inch concrete pipe that discharges into a small gully. The gully conveys runoff from Fife Heights through a heavily wooded buffer down toward Pacific Highway. The gully's eroding side slopes and channel downcutting are expected to continue as future development increases peak stormwater flow durations. The erosion could cause downstream maintenance or habitat problems due to sediment deposition, and the channel downcutting could eventually impact the house adjacent to this gully. (*Figure 5-14*)

In addition, at a public meeting property owners along 1st Street Court NE expressed concerns about flooding problems caused by street drainage sheet flowing off the cul-de-sac and into their yards. No further investigation was made into street grades that may be causing the problem or the specific locations of the uncontrolled sheet flow.

Site H-3 – 9th Street Court NE and 62nd Avenue NE down to Spring Valley Mobile Home Park

Historic flooding of the mobile home park at this location has been a concern to Water Programs. However, due to improvements by the property owner within the past year and a lack of recent complaints, flooding may no longer be a problem (Schmidt, 2004). Flow from the gully discharges into a small pond. The pond drains via a rock rip rap channel into a sediment trap before entering a 54-inch by 36-inch, corrugated arch-pipe. The arch-pipe flows under the mobile home park to an open ditch, which drains into the 42-inch WSDOT storm drain along the west side of Pacific Highway. (*Figure 5-15*)

Although the improvements at the Spring Valley Mobile Home Park provide significantly greater conveyance capacity, the size of the design storm used for the project design is not known. Therefore Water Programs staff does not know if there is capacity for future flows from increased upstream development. The size of the sediment basin appears to be small compared to the potential for sediment transport observed upstream. The existing system was constructed by the property owner and is on private property.

Site H-4 – Hylebos at 70th Avenue

Observations suggest that the flooding of I-5 in this vicinity is an ongoing problem which may become worse as development increases in the watershed upstream. During the 1996 storms the shoulder and the two inside traveled lanes on the freeway were flooded. More recently, the shoulder lanes flooded during a high-tide event that coincided with a 10-year storm event. The creek flows south at this site, then makes a nearly 90 degree turn west. In addition to increased flows, the confined channel and lack of floodplain likely contributes to this flooding. The I-5 flooding may also be exacerbated by backwater conditions caused by restrictions to downstream channel capacity, such as the ecology block bank stabilization installed along the filled areas on both sides of the creek and the bridge abutments. High tides at the mouth of the creek also cause high water levels upstream. (*Figure 5-16*) At this location, channelization of Hylebos Creek has also resulted in habitat degradation. Habitat improvement should be considered during any solution design.

Further assessment of flooding in this area would require significant hydrologic and hydraulic analysis. Approximations of the impact of local improvements may be possible using published data of stream flows and associated hydraulic grades. In addition to the technical aspects, modifications to the creek channel would require coordination with WSDOT (due to its proximity to the I-5 roadway) as well as other agencies to address environmental issues. Modifications to the channel to increase capacity would likely need to include habitat

enhancement aspects to address environmental concerns. The proposed construction of SR 167 through this area and the associated mitigation activities are expected to address this problem.

Site H-5 – Freeman Road E and 25th

A house located east of Freeman Road floods on a regular basis. On the downstream side of Freeman Road, the field also floods, but no structures are affected. The Surprise Creek drainage runs south of the property, turns 90 degrees north at Freeman Road, travels approximately 300 feet and under the homeowner's driveway, and then turns 90 degrees west under Freeman Road. The property is located at the bottom of a large, natural gully, and the contour map indicates that the house is in a low area. The low area could have been created by the construction of the roadway embankment. It is also possible that the area above Freeman Road is flooded from backwater conditions created by limited downstream conveyance capacity or the elevation of standing water in the flood plain. (*Figure 5-17*)

The area has been annexed and is no longer in unincorporated Pierce County (see *Figure 5-17*).

Site H-6 – 67th Avenue and Hylebos Creek

At this site, the major concern is flooding of property and a bridge that occurred in 1991 and 1996. The flooding has resulted from the combination of high tides with significant storms. During these events the creek overtops its banks and the water surface elevation rises above the bridge deck. Flooding of the bridge isolates one homeowner on the north side of the creek and floods several homes on the south side of the creek. The area that floods is within the floodplain for the creek. (*Figure 5-18*)

WSDOT proposes the construction of SR 167 through this area. Much of the area along the creek has been shown in preliminary WSDOT plans as planned restoration area. (www.wsdot.wa.gov/Projects/SR167/TacomaToEdgewood, July 13, 2005, and Thompson, 2004). If the project is implemented, State restoration activity could address most flooding issues in the area. If the project is not implemented, or WSDOT does not restore the area, it would be beneficial for Pierce County to acquire the properties. Property acquisition would provide the opportunity to increase natural flood plain area and to implement stream habitat enhancements.

5.1.3 Stormwater Drainage Problem Screening

The stormwater drainage problems identified above were screened by Water Programs to determine which problems should receive further discussion or analysis as part of this Plan. This screening involved determining if the problem was within County right of way, if Water Programs was responsible for addressing the problem, and if the problem warranted a Capital Improvement Project (CIP). Examples of problems that would not be selected for additional evaluation would be where the problem is due to the natural drainage characteristics of the site,

groundwater flooding, flooding on private properties not resulting from County facilities or actions, or issues that simply require routine maintenance of existing facilities.

Table 5-2 below presents the results of Water Programs final screening process.

Table 5-2
Screened List of Problems

Basin	Site ID	Nearest Street	Concern at Site	Selected for Further Activity?
Browns-Dash Point	BDP-1	Water Street NE	Possible erosion	No – The planning team did not see signs of erosion on the beach, and the extent of property that is threatened by this reported problem was not evident. There did not appear to be any recent construction or signs of repair work, and the outfall appeared to be well armored and not subject to erosion. Water Programs will monitor to determine if problem still exists.
	BDP-2	Spring Street NE	Downcutting/channel incision	Yes
	BDP-3	Dry Gulch and Varco Road	Insufficient channel and pipe capacity	Yes.
	BDP-4	Caledonia Road	Seasonal basement flooding	No – Site specific problem caused by groundwater seepage and inadequate site drains.
	BDP-5	Hyada Drainage	Possible erosion and channel incision	No – Recent work has been completed at this site. Water Programs will monitor to determine if problem still exists.
	BDP-6	Tok-A-Lou Avenue NE	Insufficient inlet and pipe capacity	Yes
	BDP-7	Wa-Tau-Ga Avenue NE	Insufficient inlet and pipe capacity; flooding out of catch basin at grade break	Yes
	BDP-7a	Layman Terrace	Insufficient inlet and ditch capacity	Yes. Water Programs may work with private property owners to address this problem.
	BDP-8	Northwood Avenue NE	Insufficient inlet and pipe capacity	Yes
	BDP-9	Tok-A-Lou Avenue NE near Ton-A-Wan-Da Avenue	Broken pipe and erosion	Yes

Table 5-2
Screened List of Problems

	BDP-10	Hyada Blvd. & La Hal Da Avenue NE	Insufficient inlet and pipe capacity	Yes
	BDP-11	Hyada & Wan-I-Da Avenue	Insufficient pipe capacity	Yes
Hylebos	H-1	8th Street E & 66th Street	Insufficient channel and culvert capacity	Yes
	H-2	66th Avenue NE	Insufficient inlet and pipe capacity; downcutting/ channel incision	Yes
	H-3	9th Street Court NE	Insufficient inlet and pipe capacity	No – Recent work has been completed at this site. Water Programs will monitor to determine if problem still exists.
	H-4	Hylebos Creek at 70th Avenue	Insufficient channel capacity	No – Water Programs may work with WSDOT to address during the SR 167 extension.
	H-5	Freeman Road East and 25th (City of Edgewood)	Insufficient pipe/culvert capacity; possibly below flood plain elevation	Recently annexed; now outside Pierce County jurisdiction.
	H-6	67th Avenue and Hylebos Creek	Insufficient channel capacity	No – Reach already identified by WSDOT for enhancement or restoration during SR 167 extension; County may work with WSDOT.

Figures 5-19 and *5-20* show the sites selected for further activities. *Table 5-2* states problems H-5 and H-6 are going to be addressees by the SR 167 extension. *Figure 5-21* shows the extent of the proposed WSDOT riparian and floodplain improvement projects.

For problems selected for further examination, existing conditions were analyzed to better understand the nature of each problem. This was accomplished by developing hydrologic and hydraulic models of each problem area. These models were then used to evaluate potential solutions. These analyses are described in greater detail in *Chapter 6* and *Appendix D*.

5.2 STREAM HABITAT AND WATER QUALITY ISSUES

Table 5-3 below summarizes stream habitat and water quality issues related to stormwater drainage in the study area. The remainder of this section discusses these issues in greater detail.

Table 5-3
Habitat and Water Quality Concerns Related to Stormwater

Basin	Concern	Description
Browns-Dash Point	Habitat	• Degradation of habitat (WDFW identification of marine fish habitat along the Browns-Dash Point shoreline) due to o sedimentation from erosion of steep slopes due channel downcutting, or o sedimentation from construction or other site disturbance activities associated with urban development, or o impacts from other contaminants (including fecal coliform, pesticides, heavy metals, etc.) found in urban runoff.
	Water Quality	• 303(d) listing of fecal coliform in Outer Commencement Bay • Illicit connections to storm drain lines • Channel erosion and downstream sedimentation • Yard waste dumping • Urban runoff with visible oily sheen, suds • Elevated arsenic levels, potentially due to smelter
Hylebos	Habitat	• Disconnection of channel and floodplain • Loss of instream habitat complexity such as LOD • Loss of riparian cover • Reduced base flows due to urbanization
	Water Quality	• 303(d) listing for fecal coliform for reaches upstream of study area • Elevated metals, fecal coliform, and oil and grease in samples collected in 1991-1993 • Elevated arsenic levels, potentially due to smelter • Illegal dumping

5.2.1 Stream Habitat Issues

Stream condition assessments were conducted through review of existing, available data. The data provided the planning team with a broad understanding of baseline stream channel habitat conditions in the two Basins. Information regarding habitat conditions was evaluated within the context of the Pre-Field Classification phase of the Urban Stream Baseline Evaluation Method

(USBEM) developed under the *Tri-County Urban Issues ESA Study* (R2 Resource Consultants, 2000). Phase I evaluation activities do not involve field visits or stream walks, but instead are based on review of aerial photos, blockage databases, and GIS data.

Under the USBEM, existing habitat is categorized as highly suitable, secondary, or negligible. Based on observed watershed and channel alterations, those study area reaches known to have presumed or documented salmonid presence were categorized as being of "secondary" suitability.

Browns-Dash Point Basin

The unincorporated Pierce County portions of the small drainages in the Browns-Dash Point area do not appear to have significant associated salmonid habitat due to steepness of the systems and low base flow from the small drainage areas. However, there are some estuary habitats, such as eel grass beds, that support surf smelt, and juvenile rearing habitats exist near marine outfalls (Molenaar, 2004). In this portion of the study area, many of the drainage problems discussed in *Section 5.1* have potentially negative habitat consequences due to their potential to cause sedimentation in nearshore areas.

Hylebos Basin

Habitat conditions along lower Hylebos Creek are generally degraded due to loss of natural floodplain through the confinement of the channel and encroachment by adjacent land uses (King County, 1990). However, no major impediments to fish passage are currently known to exist in the reaches of Hylebos Creek that lie in unincorporated Pierce County (Mahan, personal communication, 2004). The best habitat in the system currently exists in the Spring Valley area on the West Branch, within the jurisdiction of Federal Way upstream of Pierce County. This area has consistent base flows in the fall from seepages north of 356th Street that feed the stream. The area is of moderate to flat grade and still exhibits connected floodplain along the banks of the creek.

5.2.2 Water Quality Issues

This section describes general water quality issues related to stormwater drainage in the unincorporated Pierce County portions of the Browns-Dash Point and Hylebos Basins. Water quality issues were evaluated based upon review of existing information and studies.

Browns-Dash Point Basin

Outer Commencement Bay is on the Washington 303(d) list for fecal coliform, with a TMDL recommended. In other words, the presence of fecal coliform has been identified by Ecology as a water quality problem for Outer Commencement Bay. If a TMDL is written for fecal coliform, Ecology will eventually issue permits that contain limits for the amount of fecal coliform that the County and other jurisdictions can discharge to the bay. In addition, WDFW has also identified

the presence of important fish habitat along the shoreline in the Browns-Dash Point area, adjacent to outfall sites.

One way fecal coliform could be entering the bay is from untreated sewage entering stormwater conveyance systems. The Dash Point area has large unsewered areas. Septic failures have occurred, and connections of wastewater lines to the storm drainage system have been discovered. Water Programs recently completed a project at Beach Drive that resulted in the disconnection of a septic tank system overflow line that had been connected to stormwater outfalls. Fixing such cross-connections reduces loadings of fecal coliform to receiving waters.

Illegal dumping of waste is another water quality concern that was identified during site visits. Waste and debris were observed in gullies and ditches. Nutrients from yard waste can negatively affect receiving waters by reducing dissolved oxygen and transporting pesticides and herbicides.

Responses to a questionnaire sent to residents who owned properties along water bodies in the Browns-Dash Point Basin raised several water quality issues, including: erosion and soapy and/or oily stormwater during the first several storm events of the year (see *Appendix C*). Water Programs staff investigates citizen-reported problems to determine if they are related to a specific source of concern (i.e., an illicit discharge) or whether they are simply related to urban runoff.

Hylebos Basin

Apart from the water quality issues described in *Chapter 4*, interviews with Water Programs staff and basin residents did not identify additional specific water quality concerns. In response to a questionnaire sent to residents along water bodies in the Hylebos Basin, one person stated that on the southwest side of Surprise Lake, by the outlet, he has seen motor oil, transmission fluid, antifreeze, and garbage (see *Appendix C*). Since this concern is related to areas outside of Pierce County jurisdictions, the problem will be referred to the appropriate municipal authorities.

Basin Plan Area

The Plan area is essentially at the downstream end of the larger catchments. This means that what occurs within other jurisdictions can impact water quality within the Plan area. There is limited regional information available regarding recent water quality monitoring activities and results. Coordination amongst jurisdictions and information sharing has not been a standard practice.

CHAPTER SIX
Problem Analysis

This chapter describes the analyses used by the project team to define the problems identified in *Chapter Five* and develop and evaluate potential solutions. The chapter focuses primarily on the analyses conducted for site specific drainage, erosion, and flooding problems.

6.1 STORMWATER DRAINAGE, EROSION, & FLOODING ANALYSIS

Water Programs screened site-specific drainage, erosion, and flooding related problems to identify those that required further technical analysis. Engineering analyses were then performed to obtain a better understanding of the problems, to evaluate potential solutions, and to develop cost estimates.

The engineering analyses involved hydrologic and hydraulic computer simulations to identify sources and quantities of stormwater flows to each problem area and to evaluate the ability of the existing stormwater facilities to contain and convey these flows. Computer models compared the ability of the existing stormwater facilities to other alternative designs. Different structures and pipe sizes and layouts were evaluated to find alternatives that would improve the system capacity to meet County standards. Current County standards are outlined in *Pierce County Code, Title 17A, Construction And Infrastructure Regulations – Site Development and Stormwater Drainage* (Ord. 99-24S § 2 (part), 1999) and the *Pierce County Stormwater Management and Site Development Manual* (Ord. 96-46S2, 1997, as amended by Ord. 98-24, 1998). Costs were then estimated for the improvement alternatives deemed effective. Programmatic measures (e.g., development standards, educational activities) were also considered to help prevent exacerbation of existing or creation of new drainage, erosion and flooding problems. Where additional information is needed to fill gaps, studies were proposed.

6.1.1 Engineering Analyses

Storm drainage problems within the study area that were identified as needing to be addressed by the Basin Plan were typically situations where the existing facilities had not been constructed with adequate capacity to collect and/or pass the high flows (the maximum amount of stormwater runoff that is known or anticipated) that occur during storm events. A computer modeling program was used to determine how much water was likely to flow through the system from the area tributary to each problem site under existing conditions, and if development was increased to the maximum allowed by zoning (future conditions). For more detailed information regarding the technical approach used to conduct these analyses, refer to *Appendix E* and the *Pierce County Stormwater Manual.*

6.1.2 Potential Drainage, Erosion, and Flooding CIP Solutions

CIP solution alternatives considered for solving drainage, erosion, and flooding problems included:

- Peak flow attenuation through regional detention or retention;
- Conveyance improvements (enlarged storm drain pipelines, cross culverts, channel stabilization measures); and
- Property acquisition.

Stormwater detention facilities attenuate peak flows by storing stormwater runoff during peak flow events, then slowly releasing the stored water over an extended period of time. Stormwater retention facilities also store stormwater runoff during peak flow events, but they infiltrate the water into the ground rather than discharge to the surface. Stormwater retention is more desirable than detention because groundwater is recharged and base stream flows may be improved as a result. However, stormwater retention has limited applications in the Hylebos Browns-Dash Point basins due to the till layers and springs described in *Chapter Four*. Also, both regional detention and retention facilities are expensive and sometimes difficult to site.

Conveyance improvements generally involve replacing smaller, undersized pipes or surface conveyance systems with larger, more efficient systems. Conveyance improvement projects may increase floodplain storage or conveyance (e.g., setback levees) or reduce channel erosion (e.g., channel armoring, bank protection, or tightlining). Erosion related conveyance improvements can have a significant associated water quality benefit due to their resultant reduction in downstream sediment loads.

Property acquisition is an appropriate solution when vulnerable property lies within the floodplain, or when the cost of structural flood control measures is greater than the value of the property that is being protected. Acquisition projects help to preserve the natural functions of floodplains including flood storage and channel migration. Easement or property acquisition is a common component of structural projects due to the need for dedicated access to new publicly-owned facilities.

Table 6-3 on the following page provides a brief description of CIP solution alternatives analyzed for each of the problem areas. For the simpler conveyance problems, only one solution was considered.

Table 6-3
Summary of Project Recommendations

Problem/Project	Concern at Site	Proposal	Alternate Proposal
BDP-2 Spring Street	Downcutting/ channel incision	Select appropriate armor for channel conditions (flow and velocity).	Size pipe to replace channel.
BDP-3 Dry Gulch and Varco Rd	Insufficient channel and pipe capacity	Increase channel and pipe capacity upstream and at carport. Size "tightline drop" pipe down to Dry Gulch.	NA
BDP-6 Tok-A-Lou Avenue NE	Insufficient inlet and pipe capacity	Increase inlet capacity.	NA
BDP-7 Wa-Tau-Ga Avenue NE	Insufficient inlet and pipe capacity; flooding out of catch basin at grade break	Increase inlet and pipe capacity.	NA
BDP-7a Layman Terrace	Insufficient inlet and pipe capacity	Increase inlet and pipe capacity.	NA
BDP-8 Northwood	Insufficient inlet and pipe capacity	Increase inlet capacity.	NA
BDP-9 Tok-A-Lou Ave. NE near Ton-A-Wan-Da Ave.	Broken outfall pipe and erosion	Replace broken pipe.	NA
BDP-10 Hyada Blvd. and La Hal Da Ave. NE	Insufficient inlet and pipe capacity	Increase pipe capacity.	NA
BDP-11 Hyada Blvd. and Wan-I-Da Ave.	Insufficient pipe capacity	Increase pipe capacity.	NA
H-1 8th Street E and 66th St	Insufficient channel and culvert capacity	Increase channel capacity. Size culvert under 8th Street East and provide tightline conveyance through developed property.	NA
H-2 308 66th Ave. NE	Insufficient inlet and pipe capacity; downcutting/ channel incision	Increase pipe and channel capacity; select appropriate armor for channel conditions (flow and velocity) down steep slope.	Size pipe down steep slope. Include horizontal directional drilling as an option for installing pipe in the developed steep slope portion (below 1st Court).
H-5 Freeman Rd E and 25th	Insufficient pipe/culvert capacity; possibly below flood plain elevation	Increase pipe/culvert capacity (Freeman Rd, driveway, etc.). **Provide information to Edgewood**	Raise house and driveway above flood elevation. **Provide information to Edgewood**

The CIP projects recommended to address drainage, erosion, and flooding problems are described in *Chapter Seven*.

6.1.3 Cost Estimation

Following completion of hydrologic and hydraulic modeling, and identification of alternative CIP solutions, graphic representations of the potential solutions were prepared. Cost estimates for the solutions were prepared based upon these representations using a Water Programs standard basin plan CIP cost template worksheet for construction cost estimates. In some of the projects, unit costs for necessary items of work were not provided in the Water Programs template, so these unit costs were developed based on known construction costs for similar installations. Also, as described in *Chapter Four*, the arsenic contamination in the area could affect water quality from trench dewatering and handling of excavated materials; therefore, a contingency has been included in the construction budgets for projects in these areas to address the potential cost impact of arsenic and other heavy metal contamination that could be encountered during the construction of improvements.

The templates completed for each project also include a description of the problem, existing conditions and proposed improvements. *Appendix F* provides further information about the cost estimation process and contains the completed CIP cost templates.

6.1.4 Potential Programmatic Measures for Drainage, Erosion, and Flooding Problems

Programmatic measures can also be effective for addressing drainage, erosion, and flooding issues, and in prevention of future problems. Such measures can include changes to stormwater management standards, lands management programs for preserving floodplain, education, low-impact development, increased maintenance and inspection, monitoring, technical assistance, and floodplain mapping. Several countywide programmatic measures were considered to help prevent impacts associated with new development.

These include:

- **Low Impact Development** - Environmentally friendly land development practices that minimize the impact to the hydrologic cycle by maximizing on-site infiltration.
- **Update Stormwater Management Standards** - Water Programs' *Stormwater Management Standards* are being updated to ensure runoff from future developments does not adversely impact downstream properties and are designed to current professional engineering standards.

These programmatic measures are described in greater detail in *Chapter Seven*.

6.2 WATER QUALITY ANALYSIS

Available existing information about water quality in receiving waters (e.g., 303(d) listings) was used in screening potential drainage/erosion/flooding project sites for inclusion of water quality treatment. Water quality issues identified in *Chapter Five* were also evaluated qualitatively to consider potential programmatic solutions.

Protection of water quality is part of the Water Programs mission and a requirement of the County's NPDES Stormwater Permit. For the purposes of this Basin Plan, a standard method of evaluating projects to establish a threshold for when water quality should be incorporated as part of project design was developed. *Chapter Two* contains discussion regarding the NPDES permit.

6.2.1 Water Quality Treatment Screening and CIP

Each of the potential project sites and the associated structural drainage solutions was evaluated to determine whether stormwater quality treatment should be incorporated into the potential solution alternatives. The following questions were used to determine whether water quality treatment should be provided. A "yes" answer to any of the three questions indicated that water quality treatment should be considered.

1) Does the project "significantly" increase the amount of flow entering the County's storm drain system and discharging to surface waters as measured at the problem site? For example, is the proposed drainage improvement capturing flows that used to simply flow over land or infiltrate? This determination was made by evaluating if the existing conveyance system is capable of handling a potential 6 month, 24-hour storm while maintaining water quality requirements.
2) Does the project discharge to a 303(d) "Category 5: listed water body? If yes, are there any modifications to the outfall and appurtenant structures other than routine maintenance? Modifications include new construction, relocation, and/or expansion of the outfall.
3) Does the project upsize or relocate the existing outfall that discharges to a water of the state (regardless of 303(d) listing status)?

Any modifications to an outfall that discharges to a 303(d) "Category 5" water body or water way would result in consideration for water quality treatment. Alternatively, an outfall to non-303(d) waters would only be considered for retrofitting if the outfall capacity is increased. Definitions of the terms "outfall" and "water of the state" may be found in the glossary at the end of this Plan.

In general, an attempt was made to use stormwater quality treatment measures that are effective for a wide variety of pollutants of concern, including fecal coliform which is a common stormwater constituent throughout Puget Sound. As a result, the recommended stormwater treatment measures emphasize percolation of stormwater through a soil or other media layer.

The County Stormwater Manual and Ecology's *Stormwater Management Manual for Western Washington* (2005) were used to identify appropriate structural water quality treatment controls for application in the Hylebos Browns-Dash Point Basin study areas.

As a result of the water quality screening, incorporation of water quality treatment was evaluated for projects at the following problem sites: BDP-3, BDP-6, H-1 and H-2B. The specific water quality treatment mechanism is discussed with each project recommendation in *Chapter Seven*.

Additional costs for water quality treatment were developed for projects that met the screening criteria and are included in *Appendix F*.

6.2.2 Water Quality Programmatic Measures

In addition to incorporating water quality treatment into capital drainage improvement projects, programmatic measures can be highly effective for protecting water quality. County-wide programmatic measures considered for water quality include:

- **Increase Inspections** - Limited resources to implement the County's stormwater regulations can result in poor maintenance of stormwater quality facilities. Increased inspections and enforcement would help ensure compliance with stormwater quality requirements.
- **Provide Education, Outreach and Technical Assistance** - Such measures can inform citizens about the impacts of their activities on water quality and provide alternatives to reduce those impacts.
- **Provide Guidance for Surface Water Facility Maintenance** - Owners of stormwater quality treatment facilities may not understand their maintenance responsibilities. Water Programs staff has developed a guidance document (*Stormwater Maintenance Manual for Private Facilities*). This new manual provides clear, simple guidance to increase the probability of compliance and thereby improve the treatment performance of these devices.
- **Stormwater Facility Design Process** - A design process for County stormwater facilities that allows for more public input can help ensure the projects will achieve multiple benefits, such as recreation, water quality, or habitat enhancement, in addition to the core design objectives.

In addition to considering the above countywide measures, the specific nature of water quality problems in the study areas suggests some basin-specific activities, including:

- **Increased Focus on Septic Failures** - Numerous properties in the Hylebos Brown's-Dash Point Basin on septic and are close to Puget Sound. Concerns about fecal coliform in Commencement Bay suggest improved coordination between the County and the Tacoma-Pierce County Health Department would be appropriate.

- **Cross-Connection Inspections during Construction Projects** - Previous County drainage projects have identified improper connection of septic tank effluent lines to storm drains. It would be appropriate for Water Programs to continue to inspect upstream and downstream pipe segments during construction projects to identify potential illicit connections.

- **Evaluation of New Technologies for Identifying Septic Failures and Illegal Discharges** - Use of infrared photography to identify temperature differences in water (aerial thermography) is increasingly recognized as a potentially valuable approach to identifying potential sources of water quality problems.

  This approach has been used on the East Coast and should be effective in Puget Sound due to the relatively cold ambient water temperatures relative to discharges of concern (e.g., septic effluent). The County should evaluate the potential value of this technology and consider a "pilot program" effort.

- **Regional Involvement** – Involvement in a regional effort to identify information gaps and resolve them.

The above countywide and basin-specific programmatic measures and studies are described in greater detail in *Chapter Seven*.

6.3 STREAM HABITAT

As described in *Chapters Four* and *Five*, stream habitat in the Browns-Dash Point Basin is limited to a few reaches due to the natural characteristics of the systems (e.g, steep stream gradients, low flows). The Lower Hylebos mainstem on the other hand is used extensively by salmonids as they migrate to spawning areas in the upper reaches of the Basin.

Information acquired during plan development has revealed several potential opportunities for participation in restoration projects in the lower Hylebos. Restoration projects would be particularly appropriate when they have potential to fill a gap between existing or on-going projects, and thereby help to create a longer, contiguous reach of improved habitat.

This plan includes provision for one restoration project in the Lower Hylebos, along with the following types of programmatic activities:

- **Coordination of stream restoration and acquisition activities with those of other organizations and municipalities** - Known activities within the area include:
  - ✓ Friends of the Hylebos and other municipalities have recently worked on projects on the Lower Hylebos.
  - ✓ WSDOT is planning significant improvements to reaches further upstream during the planned extension of SR 167.
  - ✓ The City of Fife anticipates restoration work on the Surprise Lake tributary associated with the construction of Pacific National Soccer Park.
- **Invasive Species Management** - Such efforts could improve in-stream habitat by reducing invasive in-stream species and improving stream canopy coverage.

The above project and programmatic measures are discussed in greater detail in *Chapter Seven*.

CHAPTER SEVEN
BASIN PLAN

This Chapter contains the Hylebos Browns-Dash Point Basin Plan (Basin Plan). It is a set of recommended solutions in the form of capital improvement projects, programmatic measures and studies that if implemented, will address storm drainage and surface water management related problems identified the in previous chapters.

These are feasible solutions to achieve the goals of basin planning in Pierce County; i.e., reduce flood and storm drainage hazards, improve water quality, improve aquatic habitat potentially affected by surface water management methods, ensure coordinated and responsible use of public resources, and guide new development

The Basin Plan establishes the direction that the Water Programs Division will take within the unincorporated areas of the study area, which is comprised of the Hylebos and Browns-Dash Point Basins, over the next five to ten years. The remainder of this chapter is organized as follows:

- *Section 7.1* summarizes plan recommendations
- *Section 7.2* describes the approach used during the planning process
- *Section 7.3* presents recommended capital improvement projects
- *Section 7.4* presents recommended programmatic measures
- *Section 7.5* presents recommended studies
- *Section 7.6* presents implementation considerations

7.1 SUMMARY OF PLAN RECOMMENDATIONS

The Hylebos Browns-Dash Point Basin Plan contains 11 capital improvement projects, 14 programmatic measures, four of which are specific to the Browns-Dash Point Basin, and one study intended to address storm drainage and surface water management issues within the entire study area.

Plan recommendations are intended to reduce flood hazards, improve water quality, improve fish and wildlife habitat, facilitate coordinated and responsible use of public resources, and influence the location and methods for new development. *Table 7-1* lists each of the recommended projects and measures.

Capital improvement projects and the four programmatic measures specific to the Basin Plan have been divided into "High Priority," "Medium Priority," and "Low Priority" groups as the result of evaluation of individual projects against a set of standards contained on prioritization worksheets.

The prioritization worksheets are common to all basin plans developed by Water Programs. The worksheets document the project's or program's potential for various aspects of flood reduction, improvement of water quality, aquatic habitat protection, and other benefits using approximately 40 criteria.

The resulting level of priority is an indication of how well a project addressed multiple needs within the individual basins that comprise the study area. Some projects scored higher than others because they provided multiple benefits. An example of a CIP project that might have a higher score would be one that prevents damage to a public road, includes additional water quality features, improves salmonid habitat and protects a number of homes from flooding. Another CIP project may not provide the same levels of those same benefits, or may primarily address just one or two of those issues, so it would not score as many points.

Studies were not prioritized because they do not directly address the factors that are evaluated. Studies provide information that fills gaps. The results of studies are used to develop or refine future projects that would then be prioritized.

Appendix F contains a spreadsheet summarizing the scores assigned to each project and individual scoring worksheets for each CIP and programmatic measure.

The top 25% of the projects, based upon project scores, are designated high-priority, 50% become medium-priority, and the remaining 25% are assigned low-priority. The order within each priority group reflects project cost, from least costly to most costly. Estimated costs of recommendations by priority groups are as follows:

"High Priority" Recommendations:	**$ 791,700**
"Medium Priority" Recommendations:	**$ 2,141,900**
"Low Priority" Recommendations:	**$ 548,300**

In addition, the Basin Plan recommends $10,000 of further studies be conducted to fill information gaps. In total, cost of plan implementation is estimated to be almost $3,491,900. *Table 7-1* summarizes these recommendations in prioritized groupings and they are ranked in order by cost.

7.1.1 Capital Improvement Projects

The Basin Plan proposes an array of capital improvement projects distributed by type of problem addressed as follows:

- Road and Property Flooding - 7
- Erosion Control & Streambank Stabilization - 6
- Other Drainage Problems - 0
- Water Quality (including applicable erosion control projects, aquatic habitat restoration projects, and other types of projects with significant water quality benefits) - 4
- Aquatic Habitat Restoration – 1000 feet

Recommended CIP projects usually fall into several categories. This reflects the interrelationship of environmental factors. For example, habitat problems tend to be a secondary effect of surface water and storm drainage and water quality problems. Culverts that are a barrier to fish passage are frequently too narrow in diameter to convey the surface water volumes generated during storms, so they create backwater flooding or culverts are perched far enough above the stream channel to scour holes and destabilize adjacent areas.

Figure 7-1 shows the general locations of the recommended projects. *Section 7.3* below contains descriptions of each of capital projects.

7.1.2 Programmatic Measures

The Basin Plan recommends fourteen programmatic (non-structural) measures. The term "programmatic" relates to a plan of action or procedure for addressing a drainage need or problem. Programmatic measures include such actions as regulations, policy guidelines, site design standards, operational policies, technical assistance, enforcement, public outreach, and educational programs. Some of the programmatic recommendations are specific to the Hylebos Browns-Dash Point Basin Plan. Other programmatic activities are to be undertaken countywide.

The number of programmatic measures and the high-priority reflects a policy in the *Pierce County Comprehensive Plan* that advocates use of nonstructural solutions to storm drainage problems before committing to hard-engineered solutions. *Pierce County Code 19A.30.220.B.2* states, "Nonstructural measures should be preferred over structural measures."

Table 7-1
Recommendations Summary

Project Number	Project Name	Rating Score	Priority	Cost Estimate
PRG01-02	Check for Cross-Connections when Constructing New Drainage Projects in Browns-Dash Point Basin	226	High	$6,400
PRG01-03	Illicit Discharge Detection Pilot	241	High	$125,000
PRG04-01	Regional Coordination	244	High	$150,000
CIP04-LH1-RST01	Hylebos Creek Restoration	321	High	$510,300
			Subtotal	**$791,700**
PRG01-01	Coordinate with Tacoma-Pierce County Health Department to Prioritize Septic System Inspections	180	Medium	$5,000
CIP01-BDP6-CP01	Wa-Tau-Ga Avenue Cul-de-Sac - Storm Drain Replacement	181	Medium	$94,000
CIP01-BDP1-CP01	Spring Street NE - Install Drainage Pipe to Reduce Erosion	211	Medium	$103,800
CIP01-BDP6-OUT01	Catch Basin at Tok-A-Lou Avenue	186	Medium	$271,600
CIP04-LH1-CP01	66th Avenue and 8th St - Storm Drain Replacement	171	Medium	$387,600
CIP04-WH1-CP02	66th Avenue near 1st Street Ct - New Storm Drain	202	Medium	$536,200
CIP01-BDP4-CP01	Dry Gulch and Varco Rd - Increase Storm Drain Capacity	215	Medium	$743,700
			Subtotal	**$2,141,900**
CIP01-BDP6-CP02	Layman Terrace - Culvert and Storm Drain Replacement	80	Low	$35,300
CIP01-BDP6-MNT01	Tok-A-Lou Avenue near Ton-A-Wan-Da Avenue - Replace outfall	126	Low	$48,800
CIP01-BDP8-CP01	Northwood Avenue NE - Trash Racks for System Maintenance	82	Low	$71,600
CIP01-BDP5-CP01	Hyada Blvd at Wan-I-Da Ave. and La Hal Da Ave NE – Replace culvert and pipe	164	Low	$392,600
			Subtotal	**$548,300**
ST04-00-RST01	Hylebos Creek Restoration Opportunities	(1)	(1)	$10,000
			Subtotal	**$10,000**
PRG00-01 through PRG00-10	County-wide Programmatic Recommendations	(2)	Medium to High	(3)
Total Estimated Cost of Plan Implementation				**$3,491,900**

Recommended programmatic measures are as follows:

(1) Studies are not prioritized because they do not directly have the ability to address the factors that are evaluated.

(2) County-wide programmatic measures 1-10 have not been prioritized specific to the Browns-Dash Point or Hylebos Basins. See *Section 7.2.3*.

(3) County-wide programmatic measures 1-10 implementation costs have not been estimated for the Browns-Dash Point or Hylebos Basins. See *Section 7.2.3*.

The estimated cost for implementing the Hylebos Browns-Dash Point Creek Basin-specific recommended programmatic measures is $286,400.

7.1.3 Additional Studies

The Basin Plan recommends one basin-specific study. Priorities were not established for studies.

- Research the Potential Applicability of Aerial Infrared Thermography to Identify Failed Septic Systems and Illicit Discharges

The estimated cost of the study is $10,000. Study results will provide information needed to address current Basin issues that cannot be resolved without additional data collection and analysis. Study results will assist in the next update of the Basin Plan and implementation of recommended projects with an improved understanding of basin characteristics.

7.2 PLAN APPROACH TO STORM DRAINAGE AND SURFACE WATER MANAGEMENT ISSUES

7.2.1 Preference for Non-Structural Solutions

The 1991 Pierce County Storm Drainage and Surface Water Management Plan and the Capital Facilities Element of the Comprehensive Plan for Pierce County contain the following policy: "Nonstructural measures should be preferred over structural measures". Examples of non-structural solutions and programmatic measures include:

- Adopting an updated *Stormwater Management and Site Development Manual*
- Increasing inspections for compliance with stormwater requirements and NPDES permits

7.2.2 Low Impact Development

Urbanization alters the hydrologic regime to generate more stormwater runoff, higher velocity runoff, and less infiltration. A way of addressing these adverse effects is through Low Impact Development (LID) practices. LID can substantially reduce the rate of flow and the volume of stormwater runoff from medium and high-density areas. LID emphasizes protection and use of natural on-site features, reduction of impervious surfaces, and small-scale stormwater controls to minimize stormwater runoff and retain pre-development watershed hydrologic functions. LID combines site planning with individual best management practices to preserve natural drainage characteristics (such as soils and vegetation) and to retain and infiltrate stormwater on-site.

LID can reduce development infrastructure and related costs in many settings. LID strategies focus on evaporating, transpiring and infiltrating stormwater on site through native soils, vegetation and bioengineering applications, rather than conveying stormwater through large

stormwater facilities, pipes, and other costly, traditionally hard structural drainage systems. In addition to reduced infrastructure costs, LID practices have other economic benefits that can increase a development project's marketability, such as a community's perceived quality of life. LID stormwater facilities can be easier and less costly to maintain over time. Public and private use of LID concepts can also reduce the size of stormwater ponds, resulting in more developable land.

A sample of LID site design applications and Best Management Practices (BMPs) (Wulkan, 2001) follows:

- Developers set aside all sensitive areas and natural drainage, such as streams and wetlands. Portions of a site's trees and native vegetation are integrated into the site design.
- Specially designed bio-retention areas (or landscaped rain gardens) capture, filter and infiltrate stormwater.
- Narrower roads and use of permeable pavements on parking lots and driveways reduces impervious areas. Pervious pavements help to infiltrate stormwater at the site.
- Runoff from remaining impervious surfaces, such as rooftops, can be directed onto landscaped areas with porous soils.
- Rooftop designs can include roof gardens, which retain and slowly release stormwater.
- Soils compacted during construction are amended with compost or other organic soil conditioner that restores their capacity to hold moisture, infiltrate runoff and grow healthy plants.

The Washington Department of Ecology *Stormwater Management Manual for Western Washington* (Ecology, 2001) emphasizes the use of LID strategies wherever practicable.

LID practices can be used in parts of the Basin zoned for residential and higher density land uses. Seattle and other Puget Sound communities have demonstrated how LID principles can be successfully applied to the retrofit of existing neighborhoods. Public infrastructure improvements such as road and road drainage projects can also embody LID principles.

Programmatic Measure PRG00-01 calls for the establishment of a county-wide Low Impact Development Program that could provide LID outreach services, collaborate with the development industry and citizens to identify and solve problems and impediments to LID implementation, and coordinate LID public and private pilot projects.

7.2.3 Economic Development

Pierce County as a government and provider of public facilities and services works toward the economic health of the County and the region. Sound management of storm drainage facilities, flood hazard reduction, and protection of surface water quality makes Pierce County a more

desirable place to live and work, acts as an incentive for new business to locate here, and encourages existing businesses to stay and expand.

Basin plans lay out the surface water management needs of the basins given existing and planned development. These are the facilities and services needed to support planned levels of growth laid out in the County Comprehensive Plan. Public funds build facilities and programs that serve economic growth consistent with adopted land use plans and regulations.

7.2.4 Public Involvement and Education

A goal of public involvement is to improve public understanding of the various surface water management issues in the Hylebos Browns-Dash Point Basins, including erosion and sedimentation control, flood hazard reduction, rodent control (and its relationship to water quality), and aquatic habitat restoration and protection.

Individual recommendations of this Basin Plan should be incorporated into a comprehensive public education program that informs residents about conditions of the creeks and its watersheds, any planned capital improvement projects, and the actions of individual residents that can contribute to restoration and protection of the surface and ground water resources of the Hylebos Browns-Dash Point Basins.

A County-wide watershed education program would help to educate watershed citizens about the consequences of actions and encourage them to change their habits to protect the creeks and watersheds. Specific activities would be targeted to both young and adult audiences and would be related to existing community programs. Publicly-owned parts of creeks lend themselves to citizen involvement in stream and riparian restoration projects which enhance a sense of community stewardship for the resources.

Programmatic measure PRG00-05, *Develop and Implement and Education, Outreach and Technical Assistance Program*, could include some of the components and recommendations of this Basin Plan and could provide for public involvement and information in the Hylebos Browns-Dash Point Basins as part of the countywide program.

7.2.5 Compliance with Storm Drainage and Flood Hazard Regulations

Compliance with existing storm drainage and critical areas regulations will help to mitigate the adverse effects of future development. In addition, existing Washington State, federal and local regulations provide for water quality, habitat, critical areas and land use protection. However, compliance with regulations typically requires formal and informal enforcement, inspections, technical assistance, public information, and education.

This Basin Plan reflects Pierce County's commitment to compliance with local regulations related to flooding and water quality management, in addition to the requirements of federal and State regulations such as the federal *Clean Water Act* and Code of Federal Regulations, State water quality standards, *Endangered Species Act*, FEMA floodplain regulations and *Community Rating System*, State Hydraulic Code, *Shoreline Management Act*, and *Growth Management Act*. A compliance assurance program, implemented in a fair and consistent manner, would improve natural resource and surface water management within the Hylebos Browns-Dash Point Basins. Programmatic measure *PRG00-03, Increase Inspections for Compliance with Stormwater Requirements* and NPDES Permit, is a measure that addresses compliance assurance.

Protection of stream channels from encroachment by uses with adverse effects can also be addressed through compliance with environmental regulations. The County has development regulations intended to protect critical habitat areas (*Title 18E, Pierce County Code*) and requirements to control erosion and sedimentation during land clearing, grading, construction and in the long-term.

As an NPDES municipal stormwater permit holder, the County is required to have a program that includes the legal authority to investigate drainage problems and inspect development sites to ensure that practices in the County conform to NPDES terms and protect water quality. When administering the regulations is not enough to protect water quality, capital facilities to treat stormwater is required.

Local critical areas rules, NPDES requirements, and other federal and state rules define certain uses and activities that are prohibited within surface waters, stream, and or their buffers. Use and activity regulations prohibit new development and existing landowners from undertaking new activities that could degrade water quality, increase erosion, cause riparian damage, or lead to flooding. Some examples of prohibited activities include: destroying or altering riparian vegetation through clearing, harvesting, cutting, intentional burning, shading, or planting; application of pesticides, fertilizers, and/or other chemicals; constructing, reconstructing, demolishing, or altering the size of any structure; or activities which alter water temperature.

7.2.6 Drainage and Flood Hazard Management

Chapter Five described drainage and flood hazard problem areas throughout the Hylebos Browns-Dash Point Basins. The Basin Plan identifies projects and programs that will reduce flood hazards. The Plan contains a range of approaches to meet that goal. Pierce County participates in the *National Flood Insurance Program* administered by the Federal Emergency Management Agency (FEMA). FEMA also offers communities the opportunity to receive additional benefits through the *Community Rating System* (CRS). This program makes subsidized flood insurance available to citizens in communities that voluntarily take actions to reduce flood hazards. A community's rating affects flood insurance rates its citizens pay. Pierce County has one of the lowest flood insurance rates available. Pierce County was the first county

in the nation to achieve a "Class 5" rating" through implementation of programs that reduced flood risks.

Programmatic Measures for Flood Hazard Reduction

The Basin Plan supports county-wide programmatic measures that will serve to reduce flood hazard impacts. These include:

- **PRG00-02**, Adopt Updated Stormwater Management Standards.
- **PRG00-04**, Develop and Implement a Land Acquisition Program for Riparian and Wetland Habitat Protection and Flood Hazard Reduction.
- **PRG00-01**, Develop and Implement a Low Impact Development Program.
- **PRG00-06,** Develop and Implement an Education, Outreach and Technical Assistance Program.
- **PRG00-07,** Develop and Implement a Surface Water Management Monitoring Program.

Major Drainage Systems

Many of the creeks in the Hylebos Browns-Dash Point Basins show signs of channel erosion in their steeper reaches. CIP projects are recommended along portions of many drainage courses to stabilize eroding channels. A number of the programmatic measures in the previous sub-section would also alleviate stream channel erosion.

Minor Drainage Systems

Many of the roadway drainage systems in older developments were installed before current stormwater management standards were implemented. In some neighborhoods, the ditch and culvert system is undersized, or has been filled with sediment and no longer works as designed. Easements have also been encroached upon. Several CIP projects are recommended that address these types of problems. New developments are required by Pierce County regulations to evaluate the adequacy of the downstream drainage system to handle increased flows associated with the development, and to also meet detention standards.

7.2.7 Water Quality

The Washington State Department of Ecology has issued Pierce County a "Phase 1" Municipal Stormwater NPDES Permit, conditioned to require Pierce County to administer and enforce water quality standards adopted by the State of Washington and the federal government. One condition of the permit requires Pierce County to adopt standards equivalent to the State's Stormwater Manual.

Pierce County adopted the 1997 *Stormwater Management and Site Development Manual* as a step in demonstrating the County's intent to comply with State and federal requirements. The manual sets standards for public and private activities that affect the quality of stormwater

runoff. Adoption of the manual assumes effective administration and enforcement. Failing this, other methods such as costly stormwater treatment facilities and restoration projects become necessary. The permit also requires the County to update the manual to be equivalent with the State's most recent (2001) manual.

7.2.8 Aquatic (Floodplain) Habitat Protection

Most of the stream reaches in the Browns-Dash Point study area have negligible suitability for habitat due to steep channel gradients and lack of adequate base flows (King County, 1990). Another factor in habitat suitability is the degree of watershed and channel alteration. In general, due to extensive development and channel alterations, including straightening and confinement from the floodplain, the reaches in the Hylebos Creek study area are highly altered. Although the lower Hylebos may have provided excellent habitat historically, these reaches are now primarily used by salmonids migrating to spawning grounds in the upper reaches of the West and East Branches (King County, 1990).

There are several other organizations and jurisdictions with ongoing restoration projects in the Hylebos Basin study area, and opportunities exist for the County to perform restoration projects either on its own, or in collaboration with these other stakeholders. Therefore this Basin Plan recommends a two-pronged approach. First, the plan contains a programmatic recommendation that the County coordinate with other organizations and jurisdictions on restoration activities. Second the plan recommends a study to identify optimal sites for County-funded activities, and budgets for approximately 1000 feet of stream restoration at a site to be determined following the study.

7.3 RECOMMENDED CAPITAL IMPROVEMENT PROJECTS

This section describes specific recommendations for capital improvements to address flooding, water quality and habitat issues within the Hylebos Browns-Dash Point Basin. *Table 7-2* summarizes each project, along with priority rating and cost. The total cost of the proposed CIPs is $3,195,500.

Table 7 -2
Capital Improvement Projects Summary

Project Site	Project Number	Description of Work	Rating Score	Priority	Cost Estimate
BDP-2 Spring Street	CIP01-BDP1-CP01	Replace open channel with pipe. Install inlet structure with trash rack.	211	Medium	$103,800
BDP-3 Dry Gulch and Varco Rd	CIP01-BDP4-CP01	Increase channel and pipe capacity along Varco Rd and at carport. Install "tightline drop" pipe down to Dry Gulch. Install bioretention swale on the east side of Varco Rd. (Requires coordination with the City of Tacoma)	215	Medium	$743,700
BDP-6 Tok-A-Lou Avenue NE (4000 Block)	CIP01-BDP6-OUT01	Increase inlet capacity and construct new tightline pipe with outfall to the Sound. Install bioretention swale on the east side of Tok-A-Lou Avenue NE	186	Medium	$272,600
BDP-7 Wa-Tau-Ga Avenue NE	CIP01-BDP6-CP01	Increase channel, inlet and pipe capacity.	181	Medium	$94,000
BDP-7a Layman Terrace	CIP01-BDP6-CP02	Increase channel, inlet and pipe capacity.	80	Low	$35,300
BDP-8 Northwood	CIP01-BDP8-CP01	Increase inlet capacity; replace pipe and manhole.	82	Low	$71,600
BDP-9 Tok-A-Lou Ave. near Ton-A-Wan-Da (5000 block)	CIP01-BDP6-MNT01	Repair outfall	126	Low	$48,800

Table 7 -2
Capital Improvement Projects Summary

Project Site	Project Number	Description of Work	Rating Score	Priority	Cost Estimate
BDP-10 and BDP-11 Hyada Blvd at Wan-I-Da Ave. and La Hal Da Ave NE	CIP01-BDP5-CP01	Increase inlet and pipe capacity.	164	Low	$392,600
H-1 8th Street E and 66th St	CIP04-LH1-CP01	Increase channel capacity. Size culvert under 8th Street East and provide tightline conveyance through developed property Install bioretention swale	171	Medium	$387,600
H-2 1st St Ct NE and 66th Avenue NE	CIP04-WH1-CP02	Increase pipe and channel capacity; install pipe down steep slope. Install bioretention swale along west side of 66th Avenue NE	202	Medium	$536,200
Hylebos Creek Restoration	CIP04-LH1-RST01	Restoration of up to 1000 linear feet of riparian area and flood plain	321	High	$510,300

The remainder of this section describes each of the capital improvement projects listed above. *Figures 7-2* through *7-11* at the end of this chapter illustrate each proposed capital improvement project. The projects have been assigned individual identification numbers based upon the project type and location. The protocols for establishing those numbers are contained within *Appendix F*.

Project Number: **CIP01-BDP1-CP01**

Project Name: **"Spring Street NE - Install Drainage Pipe to Reduce Erosion"**

Cost Estimate: **$103,800**

Project Score: **211** **Priority:** **Medium**

Problem: Water exiting a stormwater pipe into a gulch has caused downcutting and erosion. A stormwater pipe and open ditch system convey stormwater from a portion of a residential neighborhood. The stormwater is conveyed through an 18-inch concrete pipe under Spring Street NE and discharges into a seasonal creek, which eventually flows into Dash Point State

Park. The erosive stormwater flows have incised approximately 100 linear feet of channel where the pipe daylights after crossing under Spring Street. In addition to the damage in the immediate problem area, the erosion can lead to high downstream levels of total suspended solids and sedimentation during storm events.

Solution: Install 200 linear feet of 18-inch HDPE pipe downstream of Spring Street NE. Tie-in to the existing culvert using a 48-inch storm drain manhole. Install a trash rack and riprap pad at downstream outlet. Install Type 2-48-inch catch basin and inlet structure (conical trash rack) at upstream end of existing culvert under the bridge. Purchase 30-foot wide easement from adjacent landowners.

Benefit: This project replaces the existing channel preventing further incision and downstream sedimentation and reducing the possibility of blocking the downstream culvert with brush or other debris. This project addresses the erosion and channel incising problem BDP-2.

Project Number: **CIP01-BDP4-CP01**

Project Name: **"Dry Gulch and Varco Rd - Increase Storm Drain Capacity"**

Cost Estimate: **$743,700**

Project Score: **215** **Priority:** **Medium**

Problem: There are several issues associated with this stormwater system:

A carport above Varco Road floods during storm events. Most of the runoff is from the plateau sub-basins east of Varco Road that are outside of unincorporated Pierce County. The upper plateau tributary areas are within the City of Tacoma and include Browns-Point Elementary School and other residential development. Over the last eight years, there have been two complaints of a carport flooding. Stormwater runoff from the plateau flows through culverts at the intersection of 51st Street and Harbor View Drive, into a channel that cuts through private property and runs adjacent to the carport of concern. Below the carport, the drainage enters the ditch system along Varco Road that discharges into Dry Gulch.

A second concern is erosion caused by stormwater flowing from Varco Road into Dry Gulch. From Varco Road to the stream bed in Dry Gulch, the drainage drops more than 100 vertical feet over a horizontal distance of approximately 250 feet. The flows entrain sediment, which is a water quality concern. In addition, large debris that moves down Dry Gulch creates a maintenance problem and may block the Dry Gulch inlet/trash rack in the ravine below the East Marine Drive bridge.

A third concern is flooding of private property at the bottom of Dry Gulch on Commencement Bay. Below the East Marine Drive bridge, ecology blocks and a large trash rack have been placed in the ravine to stabilize the stream banks and collect debris before flow enters a 42-inch underground pipe, which conveys runoff past a large residence and into Commencement Bay. If the trash rack is obstructed, flows will overtop the culvert and be intercepted by a secondary inlet structure. The secondary inlet structure consists of a 6-foot diameter trash rack and has a rock containment berm to reduce overflows. If stormwater overtops the secondary overflow structure, the residential property downstream at the mouth of the gulch may be flooded. Flooding of the residence occurred in 1990 and 1996. Coordination between the City and Pierce County will benefit implementation of this project.

Solution: Install 375 linear feet of 18-inch storm drain upstream of Varco Road (Type 1 catch basin at inlet, Type 2 catch basin at Varco Road). Install 50 linear feet of 18-inch storm drain along Varco Road leading to outlet with trash rack and riprap pad. Reconstruct 1100 linear feet of channel along Varco Road to restore 2-foot bottom width, 2:1 side slopes, and 2-foot depth. Install 50 linear feet of 18-inch storm drain to existing inlet at end of Varco Road. Install 200 linear feet of 12-inch HDPE smooth tightline (with anchors) down the gully leading to Dry Gulch. Install energy dissipation end pipe: 20 linear feet of perforated pipe, 3-inch holes. Add riprap pad below end pipe. Purchase 20-foot wide easement from adjacent landowners upstream of Varco Road and 30-foot wide easement from adjacent landowners downstream of Varco Road.

This project modifies an existing outfall to a water of the state, and was therefore identified during the screening process described in *Chapter 6* as requiring consideration of water quality treatment. The following describes the recommended water quality solution: Install 1,000 linear feet of 5-foot wide (base width), 2.5:1 side slopes, 18-inch deep bioretention swale on the east side of Varco Road. Include liner and underdrain collection pipe. This facility will allow for capture and treatment of 100% of the water quality design storm (runoff volume associated with the 6-month, 24-hour storm event). Purchase a 10-foot wide easement from adjacent landowners.

Benefit: This project increases the ditch capacity to decrease flooding and provides water quality treatment. The installation of the pipe and energy dissipater will prevent the ditch flow from eroding the toe of the slope. This project addresses flooding problem BDP-3.

Project Number: **CIP01-BDP5-CP01**

Project Name: **"Hyada Blvd. at Wan-I-Da Ave. & La Hal Da Ave. NE - Replace culvert and pipe"**

Cost Estimate: **$392,600**

Project Score: **164** **Priority:** **Low**

Problem: Ditches are regularly overtopped and the water floods the intersection and washes gravel and other sediment from the ditches out onto the pavement. Culverts collecting runoff at the intersection of Hyada Boulevard. and La Hal Da Avenue NE are poorly configured. Runoff from Hyada Blvd. flows through a 12-inch concrete culvert east to the ditch on La Hal Da Avenue and then doubles back northward into the 12-inch culvert flowing north on Hyada Blvd. which continues north toward the outfall.

The drainage system on Hyada Blvd. consists of a series of open ditches and 12-inch concrete culverts flowing northward on the east side of the street. When Hyada Blvd. turns east, drainage enters an 18-inch storm drain that crosses Hyada Blvd. and continues northward down on Wan-I-Da Avenue to an 18-inch outfall to Puget Sound. The 18-inch crossing is undersized. Surface water from east on Hyada Blvd. floods Hyada Blvd. in the vicinity of this 18-inch crossing.

Solution: The project consists of removing the section of culvert that doubles back and installing new sections of pipe and a new Type 2 48-inch catch basin. Additional capacity is needed downstream of the confluence of the two ditches, hence the existing 12-inch pipe carrying the combined Hyada and La Hal Da runoff would be replaced with an 18-inch pipe.

Hydrologic and hydraulic modeling indicated that 18-inch pipe crossing Hyada and the upstream 12-inch culvert sections are undersized. The project consists of replacing the existing 18-inch crossing with a 24-inch storm drain and replacing upstream sections of 12-inch culvert with 18-inch culverts. The model results indicated the 18-inch outfall is not undersized due to the steep slope down Wan-I-Da Avenue NE north of Hyada.

Benefit: This project increases the inlet and pipe capacity and improves the drainage system configuration. This project addresses flooding problems BDP-10 and BDP-11.

Project Number: **CIP01-BDP6-CP01**

Project Name: **"Wa-Tau-Ga Avenue Cul-de-Sac - Storm Drain Replacement"**

Cost Estimate: **$94,000**

Project Score: **181** **Priority:** **Medium**

Problem: A cul-de-sac at the end of Wa-Tau-Ga Avenue floods. Stormwater is collected along Granville Avenue NE and is conveyed by a tightline through private property to Wa-Tau-Ga Avenue. The piped flow discharges into a ditch along the east side of Wa-Tau-Ga Avenue. An asphalt/concrete berm also diverts sheet flow from the street into the ditch. At the south end of the ditch, the flow enters a culvert and is piped under the cul-de-sac, down the bluff, and out to Commencement Bay. Street runoff and any seepage that is not collected by the ditch enters the pipe system via two catch basins in the cul-de-sac. The downstream end of the pipe is a 12-inch concrete pipe that is routed beneath an old wood shed before discharging to Commencement Bay. The end of the pipe is partially obstructed by driftwood and other debris. Runoff, from the cul-de-sac and ditch overflow that bypasses the catch basins in the pavement, flows off the pavement, around the sanitary sewer pump station at the end of the cul-de-sac and down the steep slope to the shoreline. There is some erosion around the pump station and it is settling. It is not clear that the settlement of the pump station is due to surface water flows. It is possible that the movement of the station is due to consolidation of fill materials or deeper movement of the supporting soils.

Several issues appear to be contributing to this flooding and erosion problem:

- The ditch along Wa-Tau-Ga Ave may not have enough conveyance capacity.
- Culverted sections of the ditch may need repair and/or greater capacity.
- Culvert inlets may need additional regular maintenance.
- Seepage and overland flow from Granville Avenue to Wa-Tau-Ga Avenue misses the ditch and flows out onto the street.
- The tightline conveying runoff from Granville Ave. through the private property may be undersized, with resulting overflows causing erosion and contributing to overland flow onto Wa-Tau-Ga Ave. The overland flow on Wa-Tau-Ga Ave. is causing flooding and erosion around the pump station.

Solution: Install new 48-inch Type 2 catch basins on the existing storm sewer at Wa-Tau-Ga Avenue and on west side of Grandville Ave NE. Add 15 feet of 18-inch storm drain pipe on the north side of the new Wa-Tau-Ga Avenue manhole as an inlet to capture stormwater flowing south along Wa-Tau-Ga Avenue. Reconstruct 50 linear feet of channel along Wa-Tau-Ga Avenue lowering it approximately 2 feet to pipe inlet at the north side of the cul-de-sac. New channel dimensions: 2-foot bottom width, 2:1 side slopes, 18-inch depth. Install trash rack and

riprap pad at the storm drain inlet. Increase inlet and pipe capacity under cul-de-sac by replacing the existing line with 75 linear feet of 18-inch storm drain. Tie into existing manhole below cul-de-sac. Replace two existing Type 1 catch basins at cul-de-sac with Type 2 catch basins. Purchase a 20-foot wide easement from adjacent property owners. Purchase a 30-foot wide and a 20-foot wide drainage easement from adjacent property owners.

Benefit: This project increases the drainage capacity by increasing inlet and pipe capacity. This project addresses flooding problem BDP-7.

Project Number: **CIP01-BDP6-CP02**

Project Name: **"Layman Terrace - Culvert and Storm Drain Replacement"**

Cost Estimate: **$35,300**

Project Score: **80** **Priority:** **Low**

Problem: Two homes experience flooding at the end of Layman Terrace NE. Stormwater flows down Layman Terrace, across a vacant lot, and follows the existing slope to flood these homes during storm events. The flooding occurs as frequently as every five years. There is a privately owned and maintained stormwater system downstream of the County ditch. It is undersized and does not appear to be adequately maintained. The system restricts the flow of stormwater causing it to back up and overflow the road. The project would involve cooperation between the County and the parties responsible for maintenance of the private facility.

Solution: Replace culvert under the driveway with a 30-foot long 12-inch reinforced concrete pipe (RCP) with flared end sections, and riprap pads on either end. Reconstruct 100 feet of channel upstream of culvert, and 110 feet of channel downstream of culvert. Channel dimensions: 18-inch bottom width, 18-inch depth, and 2:1 side slopes. Replace the downstream catch basin grate with a beehive grate.

Benefit: This project increases the ditch and culvert capacity. This project addresses flooding problem BDP-7A.

Project Number: **CIP01-BDP6-MNT01**

Project Name: **"Tok-A-Lou Avenue near Ton-A-Wan-Da Avenue - Replace outfall" (5000 Block)**

Cost Estimate: **$48,800**

Project Score: **126** **Priority:** **Low**

Problem: An outfall to Commencement Bay requires repair. A 12-inch PVC culvert crossing Tok-A-Lou Avenue near Ton-A-Wan-Da Avenue transitions into a 12-inch concrete pipe that runs west between two residences into a catch basin near the top of the bluff. The 12-inch concrete pipe over the edge of the bluff is covered with ivy and is reported to be broken. Remnants of the pipe are visible beyond the toe of the slope along a concrete retaining wall that supports a house. The former outlet end remains encased in concrete, flush with the face of the concrete retaining wall. The property owner indicated that, during rainstorms, water flows out of the broken pipe on the slope and along the wall foundation causing erosion and potential damage to the foundation.

Solution: The project consists of replacing the existing broken pipe with a HDPE tightline over the bluff and constructing a new outfall with an energy dissipater along the existing foundation wall. The outlet and energy dissipater will need to meet environmental constraints and coordinate with the existing foundation. The project was deemed to be a maintenance project and was not considered for a water quality treatment component.

Benefit: This project replaces the broken pipe and reduces the potential damage to the foundation and erosion of the slope. This project addresses damaged pipe problem BDP-9.

Project Number: **CIP01-BDP6-OUT01**

Project Name: **"Catch Basin at Tok-A-Lou Avenue" (4000 Block)**

Cost Estimate: **$272,600**

Project Score: **186** **Priority:** **Medium**

Problem: In the past, road drainage caused bluff erosion and property damage in the Tok-A-Lou Avenue area. Some stormwater would flow past the catch basin and across the lawn between the two houses. Both the overland flow and discharge from the outfall pipe near the top of the bluff were eroding the steep bluff. The erosion damaged landscaping and could ultimately have impacted the residences.

The County addressed the overland flow problem by installing a small asphalt berm to contain and capture the street runoff. Erosion from the stormwater outfall was reduced by the installation of a plastic coated canvas sleeve to the end of the pipe which extends over the bluff and down toward the beach. The canvas sleeve extends down the bluff to approximately 5 feet above the beach and is anchored to the bluff with rebar hoops driven into the bank. The installation is considered temporary and should be replaced by a more permanent outfall.

Design of any new structures would need to address the issue of encroachment on the drainage pipe easement between the two houses by a building addition and a fence.

Solution: The existing catch basin inlet is already set as low as possible on the concrete box. Since it is located against a power pole, lowering it is not feasible. The inlet function can be improved by removing the existing pavement, regrading the street adjacent to the structure, and then restoring the pavement around the perimeter of the grate inlet at a slope that improves stormwater capture. The project also includes replacing the canvas sleeve with a permanent HDPE tightline outfall with an energy dissipater and riprap pad. Purchase 30-foot wide easement from adjacent property owners.

This project modifies an existing outfall to a water of the state, and was therefore identified during the screening process described in *Chapter 6* as requiring consideration of water quality treatment. The following describes the recommended water quality solution: Divert "base" flows up to the 6-month event peak flow from the existing storm drain on the east side of Tok-a-lou Avenue into a 240 linear feet by 5 foot wide (base width) , 2.5:1 side slopes, 18-inch deep bioretention swale. Include liner and underdrain collection pipe to prevent seepage and slope stability issues. Purchase 10-foot wide easement from adjacent property owners.

Benefit: This project increases the inlet and pipe capacity and provides water quality treatment. The installation of the new outfall and energy dissipater will provide a more permanent solution to the bluff erosion. This project addresses the outfall problem BDP-6.

Project Number: **CIP01-BDP8-CP01**

Project Name: **"Northwood Avenue NE - Trash Racks for System Maintenance"**

Cost Estimate: **$71,600**

Project Score: **82** **Priority:** **Low**

Problem: The system installed to drain a low lying area requires repairs to reduce the potential for. Stormwater flows in excess of the existing conveyance system capacity could flow

overland, behind homes in the Northwood area, prior to reaching the original flow path along the transmission line right of way. The overland flow could potentially impact the residences or improvements to the private properties.

Most of the runoff is from drainage sub-basins outside of Pierce County. Drainage flowing from the northeast is primarily from King County (approximately 31 percent of area tributary to the site) and a pipe from across Northwood Avenue collects runoff from Pierce County. Although most of the runoff is from outside Pierce County, the problem has been caused by the development inside Pierce County. It appears that when the houses were built, a portion of the low area was filled, and the natural drainage outlet was blocked. Recently, the County staff exposed an outlet pipe. This pipe runs through the backyards of the two private residences and drains the low area. Although Pierce County Water Programs and Tacoma Water rebuilt a portion of this system in 2003/2004, further repairs are needed to replace a failing catch basin and a curved pipe alignment of the pipe.

Solution: Replace existing catch basin with a Type 2 48-inch catch basin and conical trash rack at the inlet. Add 10 foot section of 12-inch storm drain pipe as a low-level inlet with a separate trash rack and riprap pad. In addition to the inlet structure, new pipe and two new Type 2 48-inch catch basins are proposed to replace the failing structure and straighten the pipe alignment at the southwest corner of No. 1920.

Benefit: This project replaces existing damaged structures and increases the inlet and pipe capacity. This project addresses potential drainage problem BDP-8.

Project Number: **CIP04-LH1-CP01**

Project Name: **"66th Avenue and 8th St - Storm Drain Replacement"**

Cost Estimate: **$387,600**

Project Score: **171** **Priority:** **Medium**

Problem: A low portion of 8th Street floods during the wet season, whenever rainfall events occur after the ground is saturated. The flooded area of 8th Street is within a drainage basin that extends approximately 3,000 feet upslope of the roadway. Contour mapping suggests runoff from this tributary area used to flow unimpeded towards a gully south of 8th Street. However, construction of the roadway embankment and improvements to the adjacent properties appear to have blocked this natural flow path. Based on these observations, flooding most likely occurs when surface runoff in the uphill roadside ditch exceed the seepage rates through the roadway subgrade. When the uphill roadside ditch is overtopped, water sheet flows across the street and

continues downslope toward a gully that forms the natural drainage path. A private driveway with a cross-culvert has been constructed across the upper end of the downslope gully. The capacity of this downstream culvert must be checked to confirm it has sufficient capacity to carry flows that may be increased due to any upstream improvements.

Solution: Construct 150 linear feet of channel along 66th Avenue: (18-inch bottom width, 2:1 side slopes, 12-inch depth). Install 18-inch RCP culvert under the two driveways. Construct 250 linear feet of channel along 8th Street (18-inch bottom width, 2:1 side slopes, 12-inch depth). Add a 30 foot long 18-inch RCP culvert under the affected driveway. Include trash racks and riprap at all culvert inlets and outlets. Install a new Type 2 catch basin on the north side of 8th street with two pipe inlets (30-foot length, 18-inch diameter) on either side. Include trash racks and riprap pads at each inlet. Add an 18-inch storm drain leading south from the new catch basin under 8th Street and continuing for approximately 500 linear feet through the developed properties. Install a trash rack and riprap pad at the outlet. Construct 50 linear feet of armored channel continuing south beyond the storm drain outlet (36-inch bottom width, 2:1 side slopes, 24-inch depth). Replace the culvert under the driveway downstream with an 18-inch culvert with a Type 2 48-inch catch basin and conical trash rack at the inlet. Purchase a 30-foot wide easement from adjacent property owners.

This project increases the conveyance capacity of an outfall to a water of the state, and was therefore identified during the screening process described in *Chapter 6* as requiring consideration of water quality treatment. The following describes the recommended water quality solution: Construct infiltration swale above the proposed conveyance/outfall pipe. The pipe may be deleted and the swale sized to accommodate the higher event flows, however, for the purposes of developing the budget estimate, it is assumed that both the pipe and swale are constructed. The proposed swale is a 500 feet long, by 10 foot wide (base width), 2.5:1 side slopes, 36-inch deep, bioretention swale. The upstream end includes a structure and outlet pipe to divert flows up to the 6 month flow from the pipe conveyance system into the swale.

Benefit: This project constructs new drainage facilities to alleviate flooding caused by modifications blocking the natural flow path. This project also provides water quality treatment. This project addresses flooding problem H-1.

Project Number: **CIP04-WH1-CP02**

Project Name: **"66th Avenue near 1st Street Ct - New Storm Drain"**

Cost Estimate: **$536,200**

Project Score: **202** **Priority:** **Medium**

Problem: The main concern at this site is potential damage to residences below 1st Street Court NE and erosion adjacent to a residence on 66th Avenue NE. Flows from 1st Street Court NE are piped through a 12-inch concrete pipe which discharges down a steep slope. There is no defined channel at the discharge location and the outflow is eroding the hillside. The existing home and a new home under construction could be damaged by flooding and/or erosion. After flowing down the steep slope, stormwater flows down a side street to 66th Avenue. At 66th Avenue, the stormwater is collected in an open ditch and transported north to where it is conveyed under the street in an 18-inch concrete pipe that discharges into a small gully. The gully conveys runoff from Fife Heights through a heavily wooded buffer down toward Pacific Highway. The gully's eroding side slopes and channel downcutting are expected to continue as future development increases peak stormwater flow durations. The erosion could cause downstream maintenance or habitat problems due to sediment deposition, and the channel downcutting could eventually impact the house adjacent to this gully.

Solution: Install a Type 1 catch basin at east end of 1st Street Court NE with approximately 50 feet of new curb around the inlet. Install 220 linear feet of 12-inch HDPE smooth-wall tightline from the new catch basin (at 1st Street Court) down the steep slope and connect to a second Type 1 catch basin at the bottom of the slope. Then add 150 linear feet of storm drain leading from that catch basin to a Type 2-48-inch catch basin at 66th Avenue. Horizontal directional drilling (HDD) should be considered during the design since it may reduce restoration costs and may be a more appropriate installation on the steep slope through developed properties. At the 66th Avenue catch basin install a 30-foot long 18-inch storm drain inlet on the south side of the catch basin to capture stormwater from the ditch flowing south to north. Then install 30 feet 18-inch diameter storm drain pipe on the north side of the 66th Avenue catch basin as an outlet discharging into the ditch along the west side of 66th Avenue north of the driveway. Install trash racks and rirap pads on both the inlet and outlet pipes. Construct 700 linear feet of 18-inch diameter HDPE downstream of the 66th Avenue culvert with two wye inlets to collect drainage off of the hillside. Purchase a 30-foot wide easement and a 20-foot wide easement from adjacent property owners.

This project modifies and relocates an existing outfall to a water of the state, and was therefore identified during the screening process described in *Chapter 6* as requiring consideration of water quality treatment. The following describes the recommended water quality solution: A portion of the flow will be treated in 500 linear feet, 5 foot wide (base width), 2.5:1 side slopes, 18-inch deep un-lined bioretention swale along the west side of 66th Avenue NE. The remainder of the 6-month flow will be retained in an open pond with a 150-foot by 150-foot (22,500 square feet) infiltration area. Purchase a 10-foot wide easement and a 200 by 200-foot wide easement from adjacent property owners.

Benefit: This project installs a pipe in the existing gully preventing further erosion and downcutting. This project also provides water quality treatment. This project addresses flooding and erosion problem H-2.

Project Number: **CIP04-LH1-RST01**

Project Name: **"Hylebos Creek Restoration"**

Cost Estimate: **$510,300**

Project Score: **321** **Priority:** **High**

Problem: Hylebos Creek reaches in the study area have been highly altered due to extensive development. Alterations that have negatively affected stream habitat include: straightening and confinement from the floodplain, loss of large organic debris, and removal of riparian vegetation.

Solution: Stream Channel and Flood Plain Restoration of up to 1000 linear feet of riparian area and flood plain.

Benefit: The Hylebos Basin is recognized as an area that has the potential to provide habitat for fish. The USBEM first phase evaluation and existing data indicate that there is a definite salmonid presence within the Hylebos system. Riparian floodplain areas and habitat are degraded by development activity and the presence of invasive species.

Although spawning and rearing habitat is very limited within the unincorporated portion of Pierce County, salmon species, including chinook, migrate through the system to areas upstream for spawning and rearing. There is benefit to improving habitat in the basin. The nature of the improvements required for salmonid habitat enhancement would also improve flood storage and conveyance in the system, and improve water quality. Restoration of the stream in this urban area would enhance the open space corridor that is identified as part of the Comprehensive Plan, and would provide recreational and educational opportunities.

There are potential projects in the Basin that have been identified by other entities. The location of the proposed restoration "project" is not defined at this time. Project locations will be determined through evaluation of actual restoration needs and communication with other groups that are undertaking restoration activities. The budget allocated to this project may be used for cooperative efforts.

7.4 PROGRAMMATIC RECOMMENDATIONS

Table 7-3 summarizes basin-specific and County-wide programmatic recommendations selected to address the drainage, erosion, flooding, water quality, and stream habitat problems and issues described in Chapter 5.

This study area represents a very small area of the County. County-wide programmatic measures have been included in this basin plan because of their inherent values, but they have not been prioritized specific to the Browns-Dash Point or Hylebos Basins nor have implementation costs been estimated because of the relatively small contribution of fees from the study area to the Storm Drainage and Surface Water Management Program.

Priorities have been presented for the County-wide proposals based upon the most common rating assigned in other basin plans that have been adopted by the County Council (Muck Creek, Gig Harbor, Mid-Puyallup, and Clover Creek) or that are near adoption at this point in time (Clear-Clarks Creek), where the programs were proposed within an individual basin plan.

Table 7-3
Summary of Programmatic Recommendations

Basin	Project Number	Description of Work	Priority
County-Wide	PRG00-01	Low Impact Development Program	High
County-Wide	PRG00-02	Update Stormwater Management Standards (Manual)	High
County-Wide	PRG00-03	Increase Enforcement Inspections	High
County-Wide	PRG00-04	Land Acquisition Program for Flood Hazard Reduction & Storm Drainage Practices Impact Mitigation	High
County-Wide	PRG00-05	Create an Education, Outreach & Technical Assistance Program	High
County-Wide	PRG00-06	Establish a BMP Manual for Surface Water Maintenance Activities	High
County-Wide	PRG00-07	Invasive Species Management Program	High
County-Wide	PRG00-08	Stormwater Facility Design Process	Medium*
County-Wide	PRG00-09	Surface Water Monitoring	Medium
County-Wide	PRG00-10	Develop and Implement Program to Enhance Riparian and Wetland Habitat, Water Quality and Provide Flood Hazard Attenuation	High
Browns-Dash Point	PRG01-01	Coordinate with the Tacoma-Pierce County Health Department to Prioritize Septic System Inspections	Medium
Browns-Dash Point	PRG01-02	Check for Cross-Connections when Constructing New Drainage Projects	High
Browns-Dash Point	PRG01-03	Illicit Discharge Detection Pilot	High
Hylebos	PRG04-01	Regional Coordination	High

* Only appears in one other basin plan at this time, Clear-Clarks Creek.

The remainder of this section describes each recommendation. Costs are not provided for recommended Countywide programmatic measures due to the relatively small size of the Browns-Dash Point and Hylebos Basin study areas relative to the other drainage basin service areas in the County.

Project Number: **PRG00-01**

Project Name: **Establish a Low Impact Development Program**

Cost Estimate: **NA**

Project Score: **NA** **Priority:** **High**

Establish a program that would work with development industry, agencies, environmental groups, and communities in the County to actively promote the use of low impact development (LID) in new development and redevelopment. Program activities might include developing standards for use of LID principles in public road construction and reconstruction, initiating and coordinating pilot projects, providing training and technical assistance in the application of LID techniques and principles, investigating regulatory and other barriers to LID and identifying solutions, and educating citizens about LID and its benefits.

Project Number: **PRG00-02**

Project Name: **Adopt Updated Stormwater Management Standards**

Cost Estimate: **NA**

Project Score: **NA** **Priority:** **High**

The Washington State Department of Ecology provided local jurisdictions, including Pierce County, with updated guidance on stormwater management standards with issuance of the 2005 Stormwater Management Manual for Western Washington. Adoption of either Ecology's manual or an equivalent manual is required for all municipalities currently covered under the National Pollutant Discharge Elimination System (NPDES) Municipal Stormwater Permit. The County should also consider adopting the optional flow duration standard for systems that drain to canyon reaches. This standard matches the existing flow duration and helps to prevent erosion in the steep, erosion-prone reaches.

Project Number: **PRG00-03**

Project Name: **Increase Enforcement Inspection for Compliance with Stormwater Requirements and NPDES Permit**

Cost Estimate: **NA**

Project Score: **NA** **Priority:** **High**

Increase inspection of public and private stormwater facilities to ensure compliance with current regulations (including NPDES requirements). Both existing and new stormwater facilities would be inspected to confirm that regular maintenance is occurring and that maintenance standards and agreements are being met. When a violation is identified, inspectors would offer education and technical assistance, but enforcement actions would be taken when necessary.

Project Number: **PRG00-04**

Project Name: **Develop and Implement a Land Management Program for Flood Hazard Reduction, Water Quality and Habitat Impact Mitigation**

Cost Estimate: **NA**

Project Score: **NA** **Priority:** **High**

Develop a system for acquiring and managing properties for multiple benefits. The program should have the following elements:

- **Standards for Property Management**: Develop standard procedures for determining which properties or types to acquire and how they can be managed for multi-use
- **Inventory Development**: Develop, reconcile, and maintain an electronic inventory of existing holdings and desired properties
- **Consultation with other Stakeholders**: Develop standards for coordination with other departments, agencies, or groups of citizens that have a stake in property acquisitions sites or the program.
- **Management**: Develop a program to manage properties. The program would address issues such as access, preventing vandalism and illegal dumping, restoration, maintenance, and liability. Pierce County may consider working with private or non-governmental agencies on mapping certain parcels where appropriate
- **Acquisition through various methods**: Pursue acquisition through fee-simple and alternatives (e.g., conservation and flood easements, rights of entry, purchase of development rights, and other legal instruments) in order to preserve high quality and flood-prone properties and to restore degraded acquisition systems.

Project Number: **PRG00-05**

Project Name: **Develop and Implement an Education, Outreach, and Technical Assistance Program**

Cost Estimate: **NA**

Project Score: **NA** **Priority:** **High**

Develop a comprehensive education, outreach, and technical assistance program for floodplain preservation that includes the following elements:

- **Public Awareness**: Activities under this element include public notification of department activities, availability of data such as updated floodplain and groundwater information and mapping, and Basin Plan-related information as it is developed.
- **Topics**: Topics may address specific pollutants such as pathogens, metals, nutrients; or issues such as illegal dumping of yard waste, flooding, lawn and garden chemicals, native plant landscaping, maintaining instream flow, or small farm management. Generally, increasing public awareness of BMPs that they can implement to reduce water quality, flooding, and habitat impacts in their basin will be the focus of each educational effort. Emergency information related to flooding needs to be well coordinated and easily accessible.
- **Target Audiences**: Audiences would include Basin residents but may also target specific stakeholders such as floodplain residents, business owners, real estate professionals, or homebuyers. Coordination with other education providers such as schools and non-governmental organizations would be addressed.
- **Methods**: Means to distribute information may include a variety of techniques such as posting information on the internet, use of libraries and public bulletin boards, speakers, news releases, newsletters, utility bill inserts, targeted mailings, fair booth displays, billboards, Pierce County Speaks segments. Methods used should be based on the information to be distributed and the target audience.
- **Technical/Financial Assistance**: In addition to basin awareness, Pierce County's education program could include an assistance program to directly aid residents in taking desired actions. This may include supporting volunteer monitoring programs, offering technical and financial assistance to floodplain residents, offering incentives for establishing buffers, and coordinating with other agencies that provide technical support such as the Conservation District. Additional incentives might come in the form of free native plants, discounts at local stores, free workshops, or tax breaks.
- **Coordination**: In order to efficiently communicate Water Programs messages, the education, outreach and other technical assistance program will include a coordination element with other agencies, groups, or jurisdictions. Coordination efforts will include other education providers but also technical staff.

Project Number: **PRG00-06**

Project Name: **Develop and Implement a BMP Manual for Surface Water Maintenance Activities**

Cost Estimate: **NA**

Project Score: **NA** **Priority:** **High**

Develop a maintenance manual containing BMPs for Pierce County's surface water management facilities. The manual would address pond, river, and levee maintenance activities. The maintenance manual would be patterned after the Tri-County transportation facilities approach and the Pierce County Stormwater Management and Site Development Manual. The manual would include practices and techniques that protect water quality and habitat while preserving the flood control functions of the facilities. The manual would provide standard operating procedures for work crews. It would also be designed to achieve compliance with Pierce County's NPDES permit. Distribution of the manual would be accompanied by training sessions on its purpose and use.

Project Number: **PRG00-07**

Project Name: **Develop and Implement an Invasive Species Management Program**

Cost Estimate: **NA**

Project Score: **NA** **Priority:** **High**

Develop a program for addressing invasive species impacts to surface water and County surface water management facilities. Pursue an Integrated Pest Management approach, and use a variety of methods, including hand pulling, mechanical harvesting, and herbicides, as appropriate. A general inventory of invasive plant problems in Pierce County would be conducted and entered into Pierce County's GIS database. A BMP manual would be developed to offer guidance in identifying problematic species, information on their preferred conditions, and options for controlling each problem species. Water Programs would confer with other agencies, including the Noxious Weed Control Board, Ecology, WDFW, and the Washington State University Cooperative Extension programs in developing the guidance document. Upon completion of the guidance document, invasive species training would be provided to drainage system maintenance personnel and invasive species issues would be included in public outreach and education programs. Water Programs would survey their facilities and properties to identify the presence of invasive species and the extent to which they are impacting the facility. This information will

be incorporated into division work plans. Implementation of this recommendation could also include organizing and orchestrating volunteer groups and working with other groups and agencies to conduct invasive species control such as hand or mechanical harvesting, native species plantings, and other techniques. This program would be applicable to all creeks and storm drainage facilities in the Browns-Dash Point and Hylebos Basin.

Project Number: **PRG00-08**

Project Name: **Develop a stormwater facility design process that integrates public involvement and alternatives for multiple uses of facility sites**

Cost Estimate: **NA**

Project Score: **NA** **Priority:** **Medium**

Initiate, coordinate with other County agencies and develop a stormwater facility design and project scope approach that can be included in Water Programs CIP project management manual. Include objectives of design process transparency and public involvement, facilities that complement the vision expressed in community plans, public safety, water quality, economic development and aquatic habitat enhancement.

Project Number: **PRG00-09**

Project Name: **Develop and Implement a Surface Water Monitoring Program**

Cost Estimate: **NA**

Project Score: **NA** **Priority:** **Medium**

Develop and implement a monitoring program that would include aspects such as water quantity, water quality, biological health, habitat, water condition sampling, data management, and reporting.

Project Number: **PRG00-10**

Project Name: **Develop and Implement Program to Enhance Riparian and Wetland Habitat, Water Quality and Provide Flood Hazard Attenuation**

Cost Estimate: **NA**

Project Score: **NA** **Priority:** **High**

Pierce County Water Programs would develop and implement projects in riparian and wetland areas that require restoration or enhancement to improve the ecosystem function, where property owners have given permission. Property owners could grant an easement to Pierce County covering all or part of their lands for habitat enhancement purposes or sell the land outright to the County. The primary function of the program would be to manage the restoration sites contained in the Basin Plan. Duties would include identifying potential projects, obtaining access, developing restoration plans, identifying resources to help in the restoration including recruiting volunteers where appropriate or hiring contractors, ordering supplies, and publicizing planting events or completed projects. The County could form partnerships with volunteer groups and other agencies.

Project Number: **PRG01-01**

Project Name: **Coordinate with Tacoma-Pierce County Health Department to Prioritize Septic System Inspections**

Cost Estimate: **$5000**

Cost Assumption: **0.2 FTE for three months**

Project Score: **180** **Priority:** **Medium**

Problem: Unincorporated areas within the Browns Dash Point Basin study area are primarily residential and largely unsewered. Failures of on-site sewage treatment systems have occurred. Due to the concern over fecal coliform in Outer Commencement Bay receiving waters, County staff should coordinate with the Tacoma-Pierce County Health Department to prioritize septic systems in the study area for higher scrutiny and inspections.

Solution: County staff will coordinate with Tacoma-Pierce County Health Department (TPCHD) to prioritize Browns-Dash Point septic systems for inspection by TPCHD.

Project Number: **PRG01-02**

Project Name: **Check for Cross-Connections when Constructing New Drainage Projects in Browns-Dash Point Basin**

Cost Estimate: **$6400**

Cost Assumption: **One day of County staff per project, 10 projects**

Project Score: **226** **Priority:** **High**

Problem: Unincorporated areas within the Browns Dash Point Basin study area are primarily residential and largely unsewered. The County has discovered septic connections to the storm drainage system during construction projects. Due to the concern over fecal coliform in Outer Commencement Bay receiving waters, the County should check for septic cross-connections during construction projects.

Solution: As additional structural drainage improvements are built, the County should inspect upstream and downstream pipes with closed circuit television cameras to locate illicit connections.

Project Number: **PRG01-03**

Project Name: **Detection of Illicit Connections, Pilot Program**

Cost Estimate: **$125,000**

Project Score: **241** **Priority:** **High**

Cost Assumptions: **½ FTE for 2 years, $5000 for Aerial Infrared Thermography, remainder for storm line videos, dye testing, smoke testing, water quality sampling, as appropriate.**

Problem: Under NPDES the County is responsible for the discharge of pollution into surface waters. In the Browns Dash Point area there are several County storm lines that discharge into Commencement Bay, which is on the 303(d) list for having high levels of fecal coliform. One potential source of fecal coliform is on-site sewage systems. Illicit connections of on-site systems to County storm lines have been found during in recent years when improvements have been made to the stormwater system. The County should be proactive in detecting such connections.

Solution: As a pilot program, the County will evaluate a suite of technologies to detect illicit connections to stormwater lines within the Browns Dash Point area. Those technologies will include smoke testing, dye testing, and Aerial Infrared Thermography. Those technologies determined to be cost effective and most effective will be utilized to find illicit connections. The program or aspects of the program will be used to develop a method for detection of illicit connections with countywide applicability.

Project Number: **PRG04-01**

Project Name: **Regional Coordination**

Cost Estimate: **$150,000**

Project Score: **244** **Priority:** **High**

Cost Assumptions: 1/10 FTE annually over a ten year period, up to $5000 per year in-kind or monetary contribution toward additional studies.

Problem: The Hylebos Browns-Dash Point Basin Plan area represents just a small part of the larger catchments. Several jurisdictions, including but not limited to the cities of Federal Way, Tacoma, Fife, Edgewood and Milton and the Puyallup Indian Tribe, along with interest groups such as Friends of the Hylebos, the Puyallup River Watershed Council and Citizens for a Healthy Bay have interest in water quality, water quantity and habitat issues within the catchments. There have been a number of independent efforts to obtain information, but there has been a lack of coordination and information exchange between groups. The Hylebos Watershed Action Committee (HWAC) is a group of agencies and interest groups that convene on a semi-regular basis to exchange and develop information about the Hylebos Basin. Water Programs can contribute resources that will strengthen the regional effort.

Solution: Water Programs will participate actively on the HWAC and contribute its fair share to support efforts to identify information currently available and to fill in information gaps.

7.5 ADDITIONAL STUDY

This section describes the additional study proposed to identify issues or concerns identified in *Chapter 5*.

Project Number: **ST04-00-RST01**

Project Name: **Hylebos Creek Restoration Opportunities**

Cost: **$10,000**

Cost Assumption: **0.05 FTE for two years**

Problem: Hylebos Creek reaches in the study have been highly altered due to extensive development. Alterations that have negatively affected stream habitat include: straightening and confinement from the floodplain, loss of large organic debris, and removal of riparian vegetation.

Solution: Evaluate Hylebos Creek habitat restoration/enhancement opportunities. Coordinate with other work performed and other proposed work in the riparian areas and creek floodplain.

7.6 IMPLEMENTATION

7.6.1 Capital Facilities Element of Pierce County Comprehensive Plan

The annually updated Capital Facilities Element of the *Comprehensive Plan for Pierce County, Washington* (Pierce County Code 19E) is the capital improvement program for Pierce County Water Programs. It lays out the capital projects over $100,000 that Water Programs intends to construct in a six-year period. It also presents the non-capital (non-structural) alternatives that can be used with capital projects to help meet the level of service standard for storm drainage and surface water management facilities. Water Programs has two entries in the Capital Facilities Plan: *19E.50.130, River Improvement Facilities*; and *19E.50.170, Surface Water Management*. The Capital Facilities Plan sets the stage for Water Programs annual budget.

7.6.2 Annual Budget for Pierce County Water Programs

The Pierce County budget each year authorizes the activities of Water Programs. Programmatic measures, studies, and capital improvement projects appear in the detailed annual budget. Capital improvement projects in the annual budget generally come from the Capital Facilities Element of the County's Comprehensive Plan described in *Section 7.4.1* or in response to an unexpected problem.

7.6.3 Order of Implementation

Implementation of the recommended actions will generally follow the prioritization groupings of "High-Priority," "Medium-Priority," and "Low-Priority" in a logical order of sequencing. To realize the full benefits of projects, implementation will not follow the exact progression of the first project to the last project in the High category, followed by the first action in the Medium category, and so forth. Several factors exist that will result in implementation of actions that are not in the exact order of the recommended actions depicted in *Table 7-1* above. Influencing factors include the following:

- Availability of funds;
- The completion of other projects or activities on which a project relies;
- Available staff and professional services;
- Cooperation from private landowners;
- Identification of a implementing agency other than Pierce County Public Works and Utilities; and
- New information, regulations, or emerging issues.

7.6.4 Economic Development Criteria

Implementing projects and programs recommended in the Basin Plan is expected to reduce flood hazards, and preserve or protect water quality and floodplain habitat. Collectively and individually, these projects are aimed at protecting Pierce County's quality of life. Projects and programs in the Basin Plan will:

- Afford resource protection as the community develops
- Preserve, enhance or protect natural floodplain functions
- Balance structural and nonstructural approaches
- Reduce potential County environmental liabilities
- Help achieve environmental compliance and long term sustainability

Collectively, these attributes help make Pierce County a livable community where quality of life issues will provide indirect, passive economic development benefits to businesses and individuals looking to locate or stay in Pierce County. In addition, Water Programs will consider the following criteria in developing its annual proposed capital facilities plan updates:

- Is the project located in an employment center zone (or handle flow from those zones)?
- Is the project located in another type of commercial zone (or handle flow from those zones)?
- Will the project reduce permitting timelines for industrial/commercial projects?

- Will the project assure access to an employment center via road and /or rail?
- Will the project increase the supply of developable property?
- Will the project reduce overall development costs?
- Are there partners willing to contribute to the development costs of the project?
- Does the project allow / provide for land development?

In light of these and other factors, following action on the Basin Plan, Pierce County will develop an implementation strategy designed to sequence, schedule and assign resources for the various recommended actions. This implementation strategy will be developed in collaboration and coordination with other potential implementers and in consideration with available financial and staff resources. The implementation strategy will include performance measurements and provide for periodic evaluation of progress.

7.6.5 Voluntary Actions by Other Interested Parties

Broad, multi-stakeholder groups such as the Puyallup River Watershed Council can be instrumental in implementation of the Basin Plan. Representatives of environmental interest groups, tribes, business, economic development, and individual citizens provide valuable suggestions about specific activities. Their support of specific activities and the ongoing progress of Basin Plan implementation will be an essential component of successful implementation. For example, these groups can be instrumental in carrying out effective public education.

Cities in the Basins can be involved in implementation of the Basin Plan recommendations. Additionally, cities can be partners in developing creek and natural resource protection strategies and in improvement of storm drainage facilities.

Landowners with extensive property along creeks can play a critical role in addressing temperature and sedimentation problems. The establishment and revegetation of riparian buffers will be an important measure for improving water quality, flood storage and habitat, particularly within the Hylebos Basin.

CHAPTER EIGHT
SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

FACT SHEET

Final Supplemental Environmental Impact Statement (FSEIS)

Title & Description of Proposed Action

Hylebos Browns-Dash Point Basin Plan. Pierce County proposes to update its *1991 Storm Drainage and Surface Water Management Plan and Capital Improvement Program* (1991 Plan) by adopting and implementing a basin-specific update for the Hylebos and Browns-Dash Point Basins. The 1991 Plan has served as a guide for the identification, design, and construction of surface water management facilities and for the implementation of surface water policies and programs throughout unincorporated Pierce County. The proposed Hylebos Browns-Dash Point Basin Plan (Basin Plan) would provide specific strategic direction for solving flooding and drainage problems associated with stormwater runoff within the Hylebos and Browns-Dash Point Basins. The No Action Alternative would continue capital project selection based on the 1991 Plan list as annually modified.

This Final Supplemental Environmental Impact Statement (FSEIS) adds information to the 1991 *Draft & Final Environmental Impact Statements* for the 1991 Plan to reflect changes to regulations and policies since 1991; stormwater facilities constructed since 1991; new development and other changes to existing conditions; and new information.

Location of Proposal

Unincorporated Pierce County, in the Hylebos and Browns-Dash Point Basins.

Proponent

Pierce County Department of Public Works & Utilities, Water Programs Division

Proponent Contact	Janine Redmond, Senior Planner Pierce County Public Works and Utilities, Water Programs 9850 64th Street West University Place, WA 98467-1078 (253) 798-7569
Lead Agency	Pierce County Planning & Land Services
Responsible Official	Charles F. Kleeberg, Director, Pierce County Planning and Land Services
Lead Agency Contact	Adonais Clark, Senior Planner Environmental Designee Pierce County Planning and Land Services 2401 South 35th Street Tacoma WA 98409-7490 (253) 798-7165
List of Permits & Approvals Required	Pierce County Storm Drainage and Surface Water Management Advisory Board review (completed January, 2006), and Pierce County Planning Commission review and recommendation (completed May, 2006). County Council approval of an ordinance adopting the Hylebos Browns-Dash Point Basin Plan as an update of the 1991 Storm Drainage and Surface Water Management Plan. After approval and adoption of the Basin Plan, construction of specific capital projects in and adjacent to water may require Hydraulic Project Approvals, Shoreline Substantial Development Permits, Section 404 Permits, Critical Areas Approvals, SEPA review, and/or other approvals at the time the projects are proposed.
Authors & Principal Contributors	Janine Redmond, Hans Hunger, Ingo Kuchta, Dan Wrye, Helmut Schmidt, and Ann Rees of the Water Programs Division of Pierce County Public Works and Utilities Department. Steve Anderson, Sherrie Chang, Tim Krause, Laura Porter, John Rundall, and Colleen Doten, of Brown and Caldwell, Inc.

Date of DSEIS Issuance	April 3, 2006
End of DSEIS Comment Period	May 2, 2006
End of Appeal Period for FSEIS	June 14, 2006
Public Meeting(s)	Two meetings were held to provide information about the proposed Basin Plan. One was on April 18, 2006 at the Fife Community Center. A second was on April 19, 2006 at the Browns Point Improvement Club. The Pierce County Planning Commission also conducted a public hearing on May 23, 2006 to review the Plan. Prior to Basin Plan adoption the County Council will schedule public hearings.
Date of Final Action	Action by the Pierce County Council is anticipated in late 2006.
Subsequent Environmental Review	Project-specific environmental review for various construction projects and programmatic actions will be performed when site and implementation alternatives are identified. Individual environmental review will precede issuance of applicable development permits or construction.
Location of Original EIS for the 1991 Plan	Pierce County Planning and Land Services 2401 South 35th Street Tacoma, WA 98409 253-798-7210 Pierce County Public Works and Utilities Environmental Services Building 9850 64th Street West University Place, WA 98467-1078 253-798-2725

Cost of FSEIS

The Basin Plan and FSEIS may be purchased for the cost of printing at:

Pierce County Public Works and Utilities
Environmental Services Building
9850 64th Street West
University Place, WA 98467-1078
253-798-2725

Information about the Basin Plan and FSEIS are also available at the following internet address: www.piercecountywa.org/hylebos

8.1 SUMMARY

Pierce County Public Works and Utilities, Water Programs Division, is proposing to adopt and implement the Hylebos Browns-Dash Point Basin Plan (Basin Plan or Plan). If adopted, the Basin Plan would update the County's *1991 Storm Drainage and Surface Water Management Plan* (1991 Plan) for the Hylebos and Browns-Dash Point Basins.

The *State Environmental Policy Act* (SEPA), Chapter 43.21C RCW, requires that an Environmental Impact Statement (EIS) be prepared for proposed actions that could result in probable significant adverse environmental impacts. Decisions on plans, policies, and programs are "nonproject actions." Nonproject EISs provide a general discussion of significant adverse environmental impacts. A nonproject EIS was prepared for the original 1991 Plan to provide full disclosure of potential impacts. That EIS compared a No Action Alternative against the measures recommended in the 1991 Plan. This FinalSupplemental EIS (FSEIS) has been prepared to determine whether substantial changes in the County programs from implementing the Basin Plan would result in "significant adverse environmental impacts" and to take into account any "significant new information" that has been developed over the past 15 years (WAC 197-11-405(4)). The FSEIS compares the implementation of the Hylebos Browns-Dash Point Basin Plan (Proposed Action) with a No Action Alternative. The No Action Alternative would be the continued implementation of the 1991 Plan.

Because the Basin Plan consists of recommendations for actions and Pierce County will not implement a particular recommendation until it is included in a Capital Improvement Program (CIP) or other approved program, this Basin Plan is considered a non-project proposal, per WAC 197-11-704 and WAC 197-11-774. Environmental review in this FSEIS is programmatic. Future project-specific environmental review, pursuant to the SEPA, will be required as specific recommendations are implemented and adverse effects can be known.

This Basin Plan is one of 10 basin plans that Pierce County is preparing to update the 1991 Plan. The 1991 Plan was adopted to provide a surface water management program for non-federal land in unincorporated Pierce County. It evaluated 26 drainage basins and identified stormwater and surface water management measures in light of the law and policies existing at the time. The basins were evaluated at different levels, depending upon whether they were considered to be urban or rural. Eight urban and urbanizing areas were studied in more detail. The Hylebos and Browns-Dash Point Basins were studied as urban areas.

Since the original 1991 Plan was prepared, surface water management has increased in complexity. Growth in Pierce County has made development impacts more widespread and obvious. In the early 1990s, the State Growth Management Act (GMA) required the designation of environmentally sensitive areas, such as wetlands and streams, the protection of adjacent buffer areas, and the adoption of an updated Pierce County Comprehensive Plan.

There has been a growing emphasis on the protection of water quality, streams, wetlands, and other environmentally sensitive areas. In the mid-1990's, jurisdictions with populations over 100,000, including Pierce County, were required to create stormwater programs under the federal Clean Water Act's National Pollutant Discharge Elimination System (NPDES) program. In the late 1990's the federal government listed Chinook salmon as endangered and bull trout found in Pierce County waters as threatened under the *Endangered Species Act* (ESA). Any adverse impact on a listed species is considered to be significant.

These factors lead Pierce County to propose the Hylebos Browns-Dash Point Basin Plan. The Basin Plan evaluates current stormwater and related surface water conditions and problems. It identifies and prioritizes recommended projects. It addresses changes in programs needed to meet the requirements of the *Clean Water Act*, the *Endangered Species Act*, and the *Growth Management Act*.

Citizens within the Basins provided input to the Basin Plan at public meetings. Their concerns regarding habitat, water quality and quantity in the basins were addressed within the Basin Plan.

The Basin Plan proposes several projects that would reduce flooding and drainage problems within the basin, improve water quality, and improve fish habitat. Some projects would become part of CIP for Water Programs, while others may be completed as part of a maintenance program or recommended to other agencies.

Several of the measures address existing flooding and drainage problems in the Basins while others address fish habitat and water quality needs of the streams. In addition, recommendations for programmatic measures (non-structural) are presented. Future basin land uses and growth, according to existing planning documents, are reviewed and determined to be compatible with the maintenance of stream hydrologic conditions. There are recommendations for more detailed studies to address needs identified in this Plan. The proposed components of the Basin Plan are described in detail in *Chapter 7*.

8.1.1 Comparison of Impacts

Table 8-1 summarizes and compares potential impacts on elements of the environment under the alternatives. Environmental impacts are discussed in the Affected Environment, Significant Impacts, and Mitigation Measures Section of this FSEIS. It is assumed that any activities that occur would be conducted in accordance with applicable land use, development and environmental regulations.

Table 8-1
Comparison of Impacts

Element	Proposed Action Basin Plan	Probable Significant Adverse Environmental Impact?	No Action Alternative	Probable Significant Adverse Environmental Impact?
Water Resources	• Temporary reductions in water quality associated with conveyance upgrade projects during construction. Mitigation measures include BMPs during construction. • Net improvement in flooding and drainage conditions on roadways and private property. • Water quality would improve because of reduced channel erosion and sedimentation. • Water quality would improve because active efforts to identify and reduce pollutant discharges would be undertaken.	• No	• Temporary reductions in water quality associated with conveyance upgrade projects during construction. • Many flooding and drainage problems would continue to occur. • Channel erosion and sedimentation would continue, which would adversely affect water quality. • Water Quality improvement activities would not be undertaken as part of a basin-specific program.	• Potential
Fishery Resources	• Potential for short-term increase in stream sediment during construction of culvert and/or pipe replacements projects. Mitigation measures include BMPs during construction. • Reduced channel erosion and sedimentation would improve water quality, which would improve fish habitat. Erosion of beaches would be reduced, which would improve nearshore habitat.	• No	• Potential for short-term increase in stream sediment during construction of culvert and/or pipe replacements projects • Habitat restoration would continue to be carried out mainly by others, with limited coordination. • Problems with channel erosion and sedimentation would continue.	• Potential

Table 8-1
Comparison of Impacts

Element	Proposed Action Basin Plan	Probable Significant Adverse Environmental Impact?	No Action Alternative	Probable Significant Adverse Environmental Impact?
	• A coordinated effort and increased resources toward stream restoration would ensure successful restoration efforts. • Restoration of up to 1,000 linear feet of riparian area and flood plain along Hylebos Creek.			
Vegetation	• Coordinated stream restoration projects would revegetate stream banks to improve habitat, reduce water temperatures, and improve water quality. • Restoration of up to 1,000 linear feet of riparian area along Hylebos Creek. • Removal of invasive species would be a positive benefit. • Minor impacts on vegetation may temporarily occur during construction activities. Any disturbed areas would be restored after construction.	• No	• Stream restoration and revegetation would not be coordinated. Less riparian vegetation would be actively restored. • Minor impacts on vegetation may temporarily occur during construction activities. • The invasive species program would not be implemented in the basins	• Potential
Wildlife	• Coordinated stream restoration projects would improve wildlife habitat. • During construction activities wildlife may be temporarily displaced. Habitat would be restored after construction. • Restoration of up to 1,000 linear feet of riparian habitat along Hylebos Creek.	• No	• Stream restoration and wildlife habitat improvements would not be coordinated, at a lower level of restoration. • During construction activities wildlife may be temporarily displaced.	• Potential

Table 8-1
Comparison of Impacts

Element	Proposed Action Basin Plan	Probable Significant Adverse Environmental Impact?	No Action Alternative	Probable Significant Adverse Environmental Impact?
	• Removal of invasive plant species during restoration projects could displace wildlife in the short term, but would positively improve wildlife habitat in the long-term.			
Land and Shoreline Use	• Development would be directed away from floodplains and valuable habitat resources towards areas with fewer constraints. • Development of stormwater facilities would be consistent with adopted policies and regulations. • The Basin Plan information would guide and/or support development of land use plans that reduce impacts on water resources and public safety.	• No	• Stormwater facility development would be consistent with adopted policies and regulations. • Continued implementation of the 1991 Plan, which predates the County Comprehensive Plan.	• Potential
Aesthetic, Historic and Cultural Resources	• Temporary aesthetic impacts associated with vegetation removal and construction activities of individual projects. • Disturbed areas would be restored after construction. • If any cultural resources were discovered during construction of individual projects, the County would immediately consult with appropriate officials regarding appropriate measures.	• No	• Temporary aesthetic impacts associated with vegetation removal and construction activities of individual projects. • Disturbed areas would be restored after construction • If any cultural resources were discovered during construction of individual projects, the County would immediately	• No

Table 8-1
Comparison of Impacts

Element	Proposed Action Basin Plan	Probable Significant Adverse Environmental Impact?	No Action Alternative	Probable Significant Adverse Environmental Impact?
			consult with appropriate officials regarding appropriate measures.	
Public Services and Utilities	• During facility construction, local roadways and service providers could be temporarily disrupted. Pierce County would coordinate mitigation measures with local service providers and utilities to avoid or reduce impacts during construction. • Implementation of the proposed projects and programs would improve long-term public safety and reduce the need for some public services.	• No	• Construction of individual projects could result in short-term impacts that could temporarily delay emergency vehicles and disrupt service providers. • Limited upgrades would reduce some of the existing flooding and drainage problems, although at a lesser extent than the Proposed Action. • Public safety and the need for some public services would be minimally improved.	• No

8.2 ALTERNATIVES, INCLUDING THE PROPOSED ACTION

8.2.1 Introduction and Background

This section describes alternatives to achieve the long-term goals of the 1991 Plan. The alternatives evaluated are the **Proposed Action**, which is the adoption of the Hylebos Browns-Dash Point Basin Plan, and the **No Action Alternative**, which is the continued use of the Capital Improvements Program element of the 1991 Plan. This section of the FSEIS also provides background on the 1991 Plan.

8.2.2 Pierce County Storm Drainage and Surface Water Management Plan (1991 Plan)

The Pierce County Council established the County's Surface Water Management Utility in March 1988 by Ordinance 87-205. In 1991, the County adopted the original Stormwater Drainage and Surface Water Management Plan (1991 Plan). The 1991 Plan was intended to provide a comprehensive program for surface water management operations, funded by service charges. The 1991 Plan also was prepared to satisfy Washington State Department of Ecology (Ecology) requirements for a *Comprehensive Flood Control Management Plan* (WAC 173-145).

The 1991 Plan addressed all 26 of the drainage basins in Pierce County, to varying degrees. Urban areas were studied in more detail than rural basins. Computer models were prepared for most of the basins, for use as analytical tools. The hydrology and flood management of the major rivers were not addressed; that area is the subject of other plans. Eight urban and urbanizing basins were studied in detail: Gig Harbor, Hylebos Creek, Clear/Clarks Creek, Clover/Steilacoom Creek, Chambers Bay, Tacoma West/Browns-Dash Point, Muck Creek, and American Lake. The rural study areas were comprised of small groups of basins: 1) Key Peninsula, Burley/Minter Creek, and Islands; 2) South Prairie Creek, Upper Carbon River, and Lower Carbon River; 3) Lower White River, Upper White River, and Mud Mountain; 4) Upper Puyallup River and Mid Puyallup River; 5) Ohop Creek, Mashel River, and Upper Nisqually River; and 6) Lower Nisqually River and Mid-Nisqually River. Surface water management objectives were developed for each basin.

The 1991 Plan included recommendations for both structural and non-structural means of accomplishing goals and objectives. The non-structural recommendations tend to be broad and countywide rather than basin or study-area specific. The 1991 Plan focused primarily on projects aimed at addressing the then-existing flooding problems. Specific flooding projects were recommended in the 1991 Plan for a Capital Improvement Program (CIP).

Four short-term and six long-term goals were developed as part of the 1991 Plan. The short-term goals were to have been implemented within two years of Plan development. They included: 1) adoption of the Plan; 2) establishment of a permanent Storm Drainage and Surface Water Management Utility; 3) provision of a funding mechanism to implement the entire plan; and 4) implementation of all the non-structural recommendations. A fifth goal, listed separately, was to adopt a drainage manual. To date, all the short-term goals have been implemented, at least in part.

The long-term goals in the 1991 Plan are goals for the life of the County's program. The goals of the 1991 Plan are listed in *Table 8-2*.

Table 8.2
1991 Plan Goals

Goal	Description	Objectives
1.) Loss Prevent the Loss of Life, the Creation of Public Health or Safety Problems and the Loss or Damage of Public and Private Property.	Prevent the loss of life or property due to flooding events.	Nonstructural measures should be preferred over structural measures. Protection of existing facilities and structures should take preference over the protection of undeveloped lands. Land use and related regulations and zoning should reflect the natural constraints of the streams, floodplains, meander zones, and riparian habitat zones. Together, this plan, program and codes should present consistent goals and objectives.
2.) Establish and Adopt a Systematic and Comprehensive Approach	Storm water management should occur in the context of an ongoing, systematic and comprehensive approach to solving existing problems and preventing future problems.	Continue the role of the Citizens Advisory Committee or similar body in an advisory role to the Utility. The body should represent the entire County and citizens with a variety or [sic] reasons for their interest in surface water management. Strategies for surface water management should balance engineering, economic, environmental, and social factors in relationship to stated comprehensive planning goals and objective. Public understanding of the various capabilities and limitation associated with storm water management should be improved through a variety of educational efforts. The goals and objective of the Master Plan should be evaluated at regular intervals (i.e., every 5 years) to maintain consistency with other related programs affecting the environment.
3) Minimize Expenditure of Public Funds	The need for emergency measures should be reduced or prevented through planning, and the use of structural and nonstructural measures.	A stable, adequate, and publicly acceptable long-term source of financing should be established and maintained for the Utility and the comprehensive management program.

Table 8.2
1991 Plan Goals

Goal	Description	Objectives
4) Maintain the Varied Uses of the Existing Natural Drainage System Within the County	Storm water management in Pierce County should occur in the context of the varied uses associated with the natural drainage systems within the County. These include agricultural, commercial, industrial and residential, fish and wildlife habitat, water supply, open space, and recreation. Preserve to the fullest extent possible, the scenic, and ecological qualities of the natural drainage system in harmony with those uses which are deemed essential to the life of its citizens, and wherever possible, enhance the instream and riparian uses of the streams, wetland and lakes of Pierce County.	Storm water management measures should preserve to the fullest extent possible opportunities for other uses. Structural flood control measures should not obstruct fish passage. Structural flood control measures should preserve or enhance existing flow characteristics for fisheries, and other uses of the riparian zone. Flood control activities should not result in a net loss of, or damage to fish and wildlife resources, but wherever possible develop or improve the diversity of habitat. Changes in land use should try to restore the lands natural character to the natural state whenever possible.
5) Prevent the degradation of the quality of both surface water and the water entering the regions aquifers.	Urbanization normally leads to a degradation in the quality of storm water runoff. This can become a problem both for the wildlife which depend on the stream system and the local populace.	The use of the natural drainage system is preferred over the use of pipelines or enclosed detention systems. The preservation of natural wetland, floodplains and streams is to be actively pursued. The County will apply for a NPDES permit and will strive to be in compliance with the requirements for the preservation of water quality. All storm water runoff from impervious surfaces should be treated before it is allowed to enter the natural drainage system, infiltrate into the ground or enter Puget Sound.

Table 8.2
1991 Plan Goals

Goal	Description	Objectives
6) Coordinate with Public and Private Sectors	Storm water management measures should be compatible with the various public and private sectors affected.	Planning and design/construction of stormwater management measures should include opportunity for comment by the general public and interested agencies. The Master Plan and its updates shall provide opportunity for identification of acceptable storm water management measures. The SWM Advisory Board should provide information about existing and pending regulations that are incompatible with the goals of the 1991 Plan. Efforts should be made to work with the Cities towards standardization of regulations which impact stormwater management.

Pursuit of these goals is still ongoing, although many of the objectives have been met. Most of the goals were strongly related to the planning, construction, operation, and maintenance of storm drainage facilities. In the 1991 Plan, the surface water management objectives for the Tacoma West-Browns/Dash Point study area included:

- Preventing existing flooding problems from becoming worse,
- Preventing stormwater problems before they occur,
- Coordinating with the City of Tacoma and King County,
- Eliminating existing flooding and erosion problems, and
- Improving water quality.

The objectives within the 1991 Plan for the Tacoma West-Browns/Dash Point study area were to reduce the potential for loss of life and property damage that currently existed and to prevent additional stormwater problems from being created by additional development within the basin. These objectives could be accomplished with the proposed CIP in conjunction with a good land use management program and stringent development standards.

For the Hylebos study area, the surface water management objectives in the 1991 Plan included:

- Preventing existing flooding problems from becoming worse,
- Preventing stormwater problems before they occur,
- Coordinating with the Cities of Fife, Milton, Federal Way, Tacoma, Puyallup, and King County, and
- Eliminating existing flooding problems.

The objective within the 1991 Plan for the Hylebos study area was to implement a program to reduce the potential for loss of life and property damage caused by increased development and surface water runoff. This objective could be accomplished with a coordinated and cooperative approach to land use and storm water management among several entities that control development within the Hylebos study area.

8.2.3 Use of the 1991 Plan As Principal Focus of CIP Has Evolved

The 1991 Plan has been used as a basis for Capital Improvement Program proposals since 1991. Projects have been selected every year and adopted by the County Council as part of the County's six-year Capital Facilities Plan under the County's Comprehensive Plan. Although many of the projects still come from the original 1991 Plan, other projects not in the 1991 Plan also have been developed as the result of more recent information. Additionally, since the 1991 Plan was developed, the cities of University Place, Lakewood, and Edgewood have incorporated and thus the County's responsibility for capital projects in those areas has been eliminated. Other cities such as Roy, Bonney Lake, and Fife have annexed adjoining areas as well, also

reducing the County's responsibilities in those areas. Project funding, planning, construction, and maintenance activities have been affected by these changes.

The 1991 Plan was developed before adoption of the Pierce County Comprehensive Plan, which was developed pursuant to the *Growth Management Act*. Zoning and other land use regulations have changed development patterns in some areas of the County, and the future growth estimates used to develop the 1991 CIP list are no longer valid.

Many of the projects proposed as part of the 1991 Plan have been constructed, while others could not be constructed because development patterns made acquisition of construction sites prohibitively expensive. Several of the smaller projects, such as culvert replacement or maintenance activities within road rights-of-way, were completed by the Transportation Services Section of Public Works and Utilities. (A determination has been made that Transportation Services is responsible for stormwater facilities located within road rights-of-way, and that Water Programs is responsible for all others.)

The 1991 Plan has been amended once, in 1995, to add several area-specific engineering studies as attachments and to incorporate other pre-existing drainage-basin analysis documents by reference. The amendment to the 1991 Plan went through public hearings before the Planning Commission and the County Council, as have changes to the annual Capital Improvement Program. Many of those studies now are no longer relevant to the Surface Water Utility program because of the changes mentioned above.

8.2.4 Proposed Action - Hylebos Browns-Dash Point Basin Plan

The Proposed Action is the adoption and implementation of the Basin Plan for surface water management for the Hylebos Browns-Dash Point Basin within unincorporated Pierce County. The proposed Basin Plan documents the existing conditions of the basin's water resources, identifies water resource problems and issues, and recommends a plan to improve conditions in the basin. The proposed Basin Plan also includes recommendations for capital projects and programmatic activities designed to remedy existing problems and to prevent future water resource problems.

Basin conditions are analyzed against the County's Basin Plan goals, engineering principles, and best management practices (BMPs) to formulate a comprehensive list of basin needs and action recommendations. Recommendations include projects, programs, and policies to address the water quality, flooding, and habitat problems identified in the proposed Basin Plan.

The potential projects included in the proposed Basin Plan would append and update the 1991 Plan and its Capital Improvement Plan. Programmatic recommendations would augment the nonstructural recommendations contained in the 1991 Plan. The proposed Basin Plan would provide guidance for Pierce County's future capital improvement projects, capital expenditures,

water resource protection policies, and public education programs in the Hylebos/Browns-Dash Point Basin.

The proposed Basin Plan has been developed to address water quantity, water quality and stream habitat concerns for the portions of the Browns-Dash Point and Hylebos Basins within unincorporated Pierce County. Through a process of investigation and analysis, specific-site improvement projects and programmatic measures have been identified for the Proposed Action.

To identify basin problems and develop potential opportunities for the Proposed Action, Pierce County collected a variety of information on the basins. The County and its planning team reviewed existing documents and the County's Service Response System (SRS), conducted field reconnaissance, prepared a citizen questionnaire, interviewed basin residents and County staff, and contacted a variety of other organizations. The County held two public meetings in the Spring of 2005 to present identified problems and potential solutions, and to solicit public input. The information collection and stakeholder involvement process is discussed in detail in Chapter 3 of the Basin Plan.

Site visits were conducted in July 2004 to identify problem sites and concerns. The identified stormwater drainage problems then were screened by the County to determine which problems should receive further analysis. The problem investigation and screening process are described in *Chapter 5* of the Basin Plan.

Storm drainage problems selected for further analyses primarily were conveyance problems, where existing facilities lacked adequate capacity to pass high flows. The planning team performed hydrologic and hydraulic analyses to better define the problems and then to evaluate potential structural solutions. This involved engineering analyses and computer simulations to replicate observed conditions and to identify improvements that would provide conveyance capacity equivalent to the County's current design flow standard. The Pierce County design flow requirements used in these analyses are outlined in the Pierce County Stormwater Management and Site Development Manual (Pierce County Stormwater Manual) (1999). *Chapter 6* and *Appendix E* of the proposed Basin Plan summarize the engineering and computer analyses used in the planning process.

After identifying the proposed infrastructure projects, the planning team developed capital project cost estimates based on unit costs provided by the County. *Appendix F* of the proposed Basin Plan provides further information about the cost estimation process.

8.2.5 No Action Alternative

The No Action Alternative would be to continue Water Programs activities as they currently exist, using the 1991 CIP as the basis for considering the County annual capital public works and work plan. As the list of high-priority projects gets completed, and as the CIP becomes more dated, the County would increasingly rely on more opportunistic means of identifying and prioritizing capital projects, such as citizen complaints and judgment of County staff. *Table 8-3* lists the original high-priority projects in the 1991 Plan for the Hylebos and Browns-Dash Point Basins. *Table 8-4* lists additional projects that have been completed in the Basins.

Table 8-3
Recommended Projects in the 1991 Pierce County Storm Drainage and Surface Water Management Plan

High Priority Projects	Estimated Cost	Project Number	Status	Notes	Basin Plan ID Code
Hylebos Study Area					
Replace 3 County-owned Culverts (because culverts did not meet 25-yr design standard)	$131,000	*HY-CULV-H (HY-HY-5, HY-WP-9, HY-WP-9A)*	Confirmed HY-HY-5 is a problem, but it is now outside County jurisdiction (located in Fife). Status on others not known		H-5
NE of I/S of 16th St. E. and 108th Ave. E. Floodplain Zoning	0 CIP cost	*HY-aDET*	Outside County jurisdiction (located in Edgewood)		
4 ponds N of 24th St. E. & W of 108th Ave. E. Floodplain Zoning	0 CIP cost	*HY-dDET*	Outside County jurisdiction (located in Edgewood)		
S of 36th St. E. & 119 Ave. extended Floodplain Zoning	0 CIP cost	*HY-eDET*	Outside County jurisdiction (located in Edgewood)		
N of 40th St. and east of 122 Ave. E. Floodplain Zoning	0 CIP cost	*HY-gDET*	Outside County jurisdiction (located in Edgewood)		
S of 24th St. E. & E of 112th Ave. E. Floodplain Zoning	0 CIP cost	*HY-hDET*	Outside County jurisdiction (located in Edgewood)		
Near 32nd St. and E of 110th Ave. E. Floodplain Zoning	0 CIP cost	*HY-iDET*	Outside County jurisdiction (located in Edgewood)		
Near I/S of 36th St. E. & 108th Ave. E. Floodplain Zoning	0 CIP cost	*HY-jDET*	Outside County jurisdiction (located in Edgewood)		
Immediately downstream of Milton Floodplain Zoning	0 CIP cost	*HY-lDET*	County has acquired some of properties. WSDOT SR 167 work would address flooding in this area.	P-4-CIP-D333	
Surprise Lake Outlet on valley floor, Flood storage/floodproof	$848,000	*HY-oDET*	Outside County jurisdiction (located in Fife)		
In Milton at confluence of forks, flood storage	$320,000	*HY-Milton*	Outside County jurisdiction (located in Milton)		

Table 8-3
Recommended Projects in the 1991 Pierce County Storm Drainage and Surface Water Management Plan

High Priority Projects	Estimated Cost	Project Number	Status	Notes	Basin Plan ID Code
Floodproof existing structures on Hylebos, floodproofing	$200,000	*HY-floodcontrol*	WSDOT SR 167 work would address flooding in this area.	WSDOT plans to acquire some properties	
Improve water quality from pipelines, Improve 2 pipeline outlets	$93,000	*HY-WQ-H*	Status not known		
Allowance for undefined projects, Misc. Projects	$600,000	*HY-misc*	Status not known		
Browns-Dash Point Study Area					
Erosion Control - Dash Point (priv)/HDPP on a steep slope	$158,000	*TW-proj(k)*	Constructed.	D801 - Markham Ave. Pipeline	

Table 8-4
Other Projects Completed in the Basins

Project Number	Project Name	Year Completed
Hylebos Basin		
CIP-5552	Caldwell Road - Pipeline	1990
CIP-5407	32nd St. E. - Pond	1990
D140	4th & 66th - Pipeline	2002
D328	1st St. & 65th - Detention Pond	1997
Browns-Dash Point Basin		
D176	Beach Dr. - Pumpstation	2005

8.2.6 Comparison of Alternatives

Table 8-5 summarizes the major characteristics of the Proposed Action and the No Action Alternative.

Table 8-5
Comparison of the Alternatives

Feature	Proposed Action (Basin Plan)	No Action Alternative
Flooding Solutions	X	X
Water Quality Solutions	X	
Habitat Solutions	X	
Annual Capital Facilities Element	X	X
Comprehensive And Strategic Planning	X	
Primary Focus On Specific Projects		X
Focus On Basin Problems	X	
County-wide Programmatic Or Non-Structural Solutions	X	X
Basin-Specific Programmatic Or Non-Structural Solutions	X	
Prioritizes Projects Within Basin	X	
Prioritizes County-wide		X

8.3 AFFECTED ENVIRONMENT, SIGNIFICANT IMPACTS, AND MITIGATION MEASURES

Both the Browns-Dash Point and Hylebos Basins are located in the northeast corner of Pierce County and are within the Puyallup Water Resource Inventory Area (WRIA) 10. Despite the inclusion in WRIA 10, both Basins release water directly into Puget Sound rather than into the Puyallup River. The Hylebos Basin covers 29 sq. mi (18,625 acres) and the Browns-Dash Point Basin covers 15 sq. mi. (9,589 acres). Both Basins straddle the Pierce/King County boundary. Because of incorporations or annexations by the Cities of Tacoma, Fife, and Edgewood, relatively little area of each basin is within unincorporated Pierce County. The entire basin planning area is within the urban service areas of the adjoining jurisdictions. Unincorporated Pierce County contains 950 acres or 5.1% of the Hylebos Basin, and 758 acres or 7.9% of the Browns-Dash Point Basin.

8.3.1 Water Resources

Affected Environment

The Browns-Dash Point and Hylebos Basins are typical of developing and urbanized areas and are experiencing drainage problems generally associated with development. The primary water quantity problems are insufficient conveyance capacity and channel erosion. The conveyance issues are the result of undersized system components (e.g., inlets, pipes, etc.), while the channel erosion has resulted from the increased runoff from upstream basin development. The identified problems include flooding caused by the absence of critical drainage facilities, undersized facilities, inadequate maintenance of existing facilities, and erosion of natural drainage channels by increased stormwater flows. The identified problems are discussed in detail in *Section 5.1* of the Basin Plan.

The Browns-Dash Point Basin is comprised of multiple smaller drainages. The majority of these drainages begin near the top of the bluffs, drain to ravines, and discharge directly into Puget Sound. Most of the problem sites in the unincorporated Pierce County portions of the Browns-Dash Point Basin are in residential areas with steep slopes. In general, flooding occurs at several of the outfall locations within Browns-Dash Point area. Existing water resources concerns for the Browns-Dash Point Basin include beach erosion from stormwater discharge, erosion of natural channels within steep slopes, high downstream levels of total suspended solids and sedimentation during storm events, and flooding of private property.

The unincorporated areas of Pierce County within the Browns-Dash Point Basin are primarily residential. Although no stormwater monitoring data exist for this area, urban runoff from the Browns-Dash Point neighborhoods can be expected to contain pollutants and concentrations similar to those observed in runoff from other Northwest communities. The Dash Point area is largely unsewered, and the septic systems contribute to water quality concerns. Septic failures have occurred, which are a common source of fecal coliform bacteria and nutrients, among other

pollutants. Moreover, outer Commencement Bay is on the Washington 303(d) list for fecal coliform, with a total maximum daily load (TMDL) recommended. In the Hylebos Creek Basin, existing problems from drainage, flooding, and erosion in unincorporated Pierce County typically are related to increased runoff from development in the Fife Heights area or to floodplain filling along the lower Hylebos. The most substantial flooding on the lower Hylebos occurs where it crosses under Interstate 5 and Hwy 99. Existing water resources concerns within the Hylebos Basin include floodwater encroaching into Interstate 5, flooding of residences, and eroding side slopes and downcutting of channels.

In 1983, the U.S. Environmental Protection Agency (EPA) declared the Commencement Bay Nearshore Tideflats to be a Superfund clean-up site. The Hylebos waterway also is designated for environmental cleanup under the Superfund law. The Superfund designations are related to historic industrial uses, rather than to urban stormwater runoff from unincorporated Pierce County. In addition, segments of the Hylebos Creek mainstem and the West Fork, just upstream of the Pierce County line, are listed for fecal coliform violations on the Washington 303(d) list, with TMDLs potentially pending.

Little additional information is available regarding water quality in the basin planning area. The 1991-1993 study conducted by the Tacoma-Pierce County Health Department (TPCHD) found that about 57% of the samples exceeded "action limits," primarily for copper, zinc, lead, and arsenic. A few samples exceeded the action limits for oil & grease (TPCHD, 1993). Only two samples were analyzed for fecal coliform bacteria, and both exceeded the state standards. The observed concentrations for these parameters are within the range typically observed in runoff from residential and commercial areas in the Northwest. However, the elevated arsenic may reflect aerial deposition from the former ASARCO smelter on Ruston Way in Tacoma.

Significant Impacts and Mitigation Measures

Proposed Action (Basin Plan)

The proposed Basin Plan identifies a series of CIP projects and programmatic measures to relieve flooding and drainage problems. The CIP projects include eight projects in the Browns-Dash Point Basin and three projects in the Hylebos Basin (*Table7-2*). These projects consist mainly of improving conveyance capacity by increasing channel, inlet, and/or pipe capacity. The long-term effects of these projects would be a net improvement in the flooding and drainage conditions in the Hylebos and Browns-Dash Point Basins. The proposed projects also would reduce channel erosion and sedimentation, which would improve water quality. Many of the proposed CIP improvements are site-specific in nature, and are designed to deal with existing site-specific flooding issues.

The local drainage improvement projects generally would involve the installation of short lengths of storm pipes and other facilities to improve local drainage. None of these CIP projects would have a significant long-term adverse impacts on streams in the Basins.

Construction of many of the CIP projects would have the potential for short-term impacts on water quality, particularly those constructed within or adjacent to the streams. Sediment would be mobilized and quickly carried downstream, temporarily reducing water quality. Subsequent deposition of sediment also could harm fish habitat. As mitigation measures during construction of individual projects, standard erosion control measures and BMPs would be implemented to avoid serious sedimentation problems. Standard erosion control measures such as silt fencing, coverage of exposed earth, and permanent seeding of disturbed areas following construction would further reduce temporary sediment and water quality impacts. Construction work adjacent to or within streams would be limited to low-flow periods, typically the summertime.

Construction of each project would be required to meet Pierce County construction and erosion control requirements, as well as applicable state and federal requirements. For instance, those projects taking place within a stream would require a Hydraulic Project Approval (HPA) from the Washington State Department of Fish and Wildlife. The standard requirements for control of erosion and other construction-related pollutants, such as fuels and lubricants, would assure that the water quality impacts would be short term and not significant.

The CIP projects would improve the existing flooding and drainage conditions in the Hylebos and Browns-Dash Point Basins. Future growth and land uses within some areas, however, could exacerbate existing problems or create new problems. The primary area of concern in this regard is Fife Heights, where additional development is anticipated, and future flow increases could result in additional downstream flooding and erosion impacts. The proposed Basin Plan includes programmatic measures to address potential impacts from future development. Implementation of the runoff control measures included in the updated Pierce County Stormwater Management and Site Development Manual would address stormwater impacts from future development.

The Dash Point area is largely unsewered, and the septic systems have contributed to water quality concerns. The proposed Basin Plan includes a programmatic measure to prioritize the septic systems in these areas for higher scrutiny and inspections, in coordination with the Tacoma-Pierce County Health Department. Improved septic systems in the Browns-Dash Point Basin would reduce the concerns over fecal coliform in basin receiving waters.

Overall, implementation of the proposed Hylebos Browns-Dash Point Basin Plan is expected to result in a major long-term benefit to the water resource and water quality conditions within the Basins. No significant adverse environmental impacts on water resources are likely under the Proposed Action.

No Action Alternative

Under the No Action Alternative, stormwater would continue to be managed in the Hylebos and Browns-Dash Point Basins as it is today. County efforts would continue to focus on serious drainage complaints rather than assuming a more proactive, comprehensive approach. Periodic

maintenance of ditches, culverts, and other County drainage facilities by County crews would continue.

During construction of any individual project, the short-term impacts and mitigation measures would be similar to those discussed under the Proposed Action. However, the identified flooding and drainage problems would continue to occur. As further development occurs, drainage problems are expected to intensify. Further development in accordance with the current Comprehensive Plan could increase flood flows and erosion in much of the system.

Implementation of the No Action Alternative would not address many of the flooding and drainage problems identified in the Hylebos and Browns-Dash Point Basins, and would not result in the major long-term benefits to water resources and water quality compared with the Proposed Action. Many flooding and drainage problems would continue to occur, particularly at locations not covered by the 1991 Plan. Channel erosion and sedimentation would continue, which would adversely affect water quality. Because of the lower focus on water resources, potential significant environmental impacts to water resources have been identified as resulting from the No Action Alternative.

8.3.2 Fishery Resources

Affected Environment

The streams of the Hylebos and Browns-Dash Point Basins support several species of salmonids. *Table 4-4* of the Basin Plan lists the fish species documented in the streams of the Hylebos and Browns-Dash Point Basins. In the Browns-Dash Point Basin, coho salmon have been documented in Reach 1, while salmon are assumed to be absent in the remaining reaches. In the Hylebos Basin, documented species include coho salmon, fall Chinook, fall chum salmon, pink salmon, and winter steelhead.

In the late 1990's the federal government listed Chinook salmon as endangered and bull trout found in Pierce County waters as threatened under the *Endangered Species Act* (ESA).

Available stream habitat information was evaluated within the context of the Pre-Field Classification phase of the Urban Stream Baseline Evaluation Method (USBEM) developed under the *Tri-County Urban Issues ESA Study* (R2 Resource Consultants, 2000). This technique does not involve field visits or stream walks, but instead is based on review of aerial photos, blockage databases, and GIS data. The intent of the Pre-Field phase is to identify whether potential stream reaches provide highly suitable, secondary, or negligible fish habitat. Those reaches that provide highly suitable or secondary habitat would then be considered for more detailed field surveys to better ascertain existing habitat quality and identify potential conservation or restoration opportunities.

As a result of the Pre-Field work, most of the stream reaches in the Browns-Dash Point study area (with the exception of BDP1-R1, R3 and R5) were categorized as of negligible suitability for habitat due to steep channel gradients and lack of adequate base flows (King County, 1990). Another factor in habitat suitability is the degree of watershed and channel alteration. In general, due to extensive development and channel alterations, including straightening and confinement from the floodplain, the reaches in the Hylebos Creek study area were determined to have a "high" level of alteration. Therefore, Hylebos Creek study area reaches known to have presumed or documented salmonid presence were categorized as being as being of "secondary" suitability. Although the lower Hylebos may have provided excellent habitat historically, these reaches are now primarily used by salmonids migrating to spawning grounds in the upper reaches of the West and East Branches (King County, 1990).

Significant Impacts and Mitigation Measures

Proposed Action (Basin Plan)

The Basin Plan includes a series of proposed CIP projects and programmatic measures that would relieve flooding and drainage problems, which would indirectly benefit the fishery resources of the Hylebos and Browns-Dash Point Basins. The Proposed Action would reduce channel erosion and sedimentation, and would lower downstream levels of total suspended solids and sedimentation during storm events. Improvements in water quality would benefit the fisheries resources of the basins. Erosion of beaches would be reduced, which would improve nearshore habitat. One CIP project would restore up to 1,000 linear feet of riparian area and flood plain along Hylebos Creek. None of the CIP projects would have a significant long-term adverse impact on the fisheries resources within the streams of the Basins.Construction of many of the CIP projects would have the potential for short-term impacts on fishery resources, primarily from temporary erosion and sedimentation. As mitigation measures during construction of individual projects, standard erosion control measures and BMPs would be implemented to avoid serious erosion and sedimentation problems. Using properly implemented and appropriate erosion controls and BMPs, short-term impacts on fish habitat would be minor. As discussed previously under Water Resources, construction of each project would be required to meet Pierce County and state erosion control requirements.

The proposed Basin Plan includes programmatic measures to restore stream habitat in the Hylebos Basin. The potential for habitat restoration exists up and downstream along I-5 and in the lower reaches of the Hylebos Mainstem. The Proposed Action would coordinate stream restoration and acquisition activities with appropriate jurisdictions and organizations, such as the Friends of the Hylebos and the Washington Statement Department of Transportation (WSDOT). A coordinated effort toward stream restoration would help ensure successful restoration efforts. Stream restoration activities would improve fish resources by creating complex habitat with adequate pools and riffles, providing overhead cover, increasing shade to reduce peak water temperatures, stabilizing banks to reduce sedimentation, and planting a vegetative buffer. Stream restoration would indirectly benefit riparian vegetation and wildlife.

Implementation of the proposed Hylebos Browns-Dash Point Basin Plan would result in long-term benefits to the fishery resources within the Basins. Short-term impacts during construction would be minor and would last for only a short period, and would be mitigated with BMPs. No significant adverse environmental impacts on fishery resources would occur under the Proposed Action.

No Action Alternative

Improvements to fish habitat would continue in the basins, but at a lower level compared to the Proposed Action. Under the No Action Alternative, County resources and coordination would be limited.

Under the No Action Alternative, stormwater would continue to be managed in the Hylebos and Browns-Dash Point Basins as under the 1991 Plan. Short-term impacts and mitigation measures associated with construction of capital facilities projects listed in the 1991 CIP would be similar to those discussed under the Proposed Action.

The No Action Alternative would not address many of the water quality and fish habitat problems identified in the Hylebos and Browns-Dash Point Basins. Problems with channel erosion and associate water quality impacts would continue at locations not covered by the 1991 Plan. Implementation of the No Action Alternative would not result in the major long-term benefits to fishery resources compared with the Proposed Action. Given the lesser focus on fishery resources under the No Action Alternative, the No Action Alternative would pose a potential for significant impacts on fishery resources.

8.3.3 Vegetation

Affected Environment

The unincorporated areas of Pierce County within the Browns-Dash Point Basin are primarily residential. The residential development has altered much of the vegetation, and the remaining upland habitat in the Basin is not considered significant. Most of the uplands in the Basin have been disturbed, leaving fragmented patches of forestland and grassland in a matrix of suburban development. Existing vegetation includes coniferous and deciduous trees and landscaped residential areas. With the changes in land use, several invasive species have established themselves throughout the Basin.

The Hylebos Basin is relatively less developed. The upper parts of Hylebos Creek include forested areas, wetlands, and riparian habitats. Habitat conditions in the lower Hylebos are degraded generally because of the confinement of the channel and encroachment by adjacent land uses. The best habitat in the system currently exists in the Spring Valley area on the West Fork, in the jurisdiction of Federal Way. The potential for habitat restoration exists up and downstream along Interstate 5 and in the lower reaches of the Hylebos Mainstem. Hylebos

Creek and its tributaries support several salmonid species (see *Section 8.3.2*, Fishery Resources, above).

Pierce County has mapped wetlands as Critical Area Resource Lands. The Brown-Dash Point Basin study area has few mapped wetlands (*Figure 4-1* of the Basin Plan). The wetland categories represented on the figure were assigned pursuant to Pierce County Critical Area regulations that were effective until March 1, 2005. If the wetlands are re-evaluated under current rating criteria those categories may change. Current rating criteria for wetlands are contained within Section 18E.30.70, *Appendix A* of Pierce County Code Title 18E and the Washington State Wetland Rating System for Western Washington, revised April 2004 (Ecology Publication #04-06-025).

In the Browns-Dash Point Basin, the wetlands shown on the *Figure 4-1* have been rated as Category 3 wetlands (under the pre-2005 County rating system). The Hylebos Basin study area has one large Category 2 wetland (~ 64 acres), which correlates to the floodplain area, and eight uncategorized wetlands (~15 acres) (*Figure 4-8* of the Basin Plan).

Proposed Action (Basin Plan)

Most of the proposed CIP projects would result in minimal impacts on vegetation within the Hylebos and Browns-Dash Point Basins. Vegetation adjacent to the proposed projects, where present, could be disturbed by construction activities. Any disturbed areas would be restored and revegetated after construction. As a mitigation measure, revegetation would use native vegetation where possible. None of the CIP projects would have a significant long-term adverse impact on the vegetation within the Basins. One CIP project would restore up to 1,000 linear feet of riparian area along Hylebos Creek, which would be a positive benefit. The Basin Plan includes proposed programmatic measures to restore stream habitat in the Hylebos Basin. Coordinate stream restoration projects could increase riparian area vegetation and provide vegetative buffers. Native vegetation would be planted where possible. Restoration of riparian vegetation would improve fish and wildlife habitat. One programmatic measure would be the implementation of an Invasive Species Management Program. Removal of invasive species would be a positive benefit for vegetation and an indirect benefit for wildlife.

No significant adverse environmental impacts on vegetation would occur under the Proposed Action.

No Action Alternative

Improvements to vegetation would continue in the basins, but at a lower level of coordination and resources compared to the Proposed Action. Less riparian vegetation would be actively restored under this alternative, because of the lack of a coordinated restoration program.

The No Action Alternative would not address many of the vegetation and habitat issues identified in the Hylebos and Browns-Dash Point Basins. The invasive species program would not be implemented in the basins. Given the lesser focus on vegetation and riparian habitat under the No Action Alternative, the No Action Alternative would pose a potential for significant impacts on Vegetation.

No significant impacts on vegetation have been identified as resulting from the No Action Alternative.

8.3.4 Wildlife

Affected Environment

The Browns-Dash Point and Hylebos Basins contain a variety of habitat types that are the result of the marine influence off Puget Sound, the glacial plains (soils) and associated vegetation, and the various hydrological and topographical features of the Basins. Wildlife found in the project area consists of native wildlife associated with the lowlands of Puget Sound, and with wildlife found in suburbanized human environments that can tolerate or benefit from close association with humans and habitat fragmentation.

A wide variety of wildlife occurs or potentially occurs in the Browns-Dash Point and Hylebos Basins. Blacktail deer, raccoon, beaver, coyote, and a variety of bats and rodent species commonly inhabit the remaining forest areas. The wetlands and riparian areas provide habitat for native wildlife such as raptors, small mammals, and waterfowl. The developed residential areas, with limited landscaping, provide habitat for songbirds and small mammals.

A number of species are in decline and have special state or federal designation, which also is referred to as Species of Concern. These include the peregrine falcon, bald eagle, and marbled murrelet, which are federally listed threatened species.

The Basin Plan area contains documented raptor habitat and active nests, including Bald eagle nest areas. Lower portions of the larger Basins contain nesting and feeding habitat for seabirds and marine mammals.

Significant Impacts and Mitigation Measures

Proposed Action (Basin Plan)

Construction activities within the Plan area will be subject to additional reviews under applicable regulations. These reviews could include environmental review (SEPA, NEPA), Shoreline Management Act compliance, Critical Areas compliance, ESA assessment, NPDES compliance, water quality (Army Corps of Engineers 404 Permit and Department of Ecology 401 Certification) and Hydraulic Project Approval. All activities would occur in a manner consistent with temporal and physical conditioning of approvals received from the regulatory agencies.

Most of the proposed CIP projects would result in minimal impacts on wildlife and wildlife habitat within the Hylebos and Browns-Dash Point Basins. Construction activities could disturb riparian vegetation, which could temporarily affect local wildlife. As a mitigation measure, any disturbed areas would be revegetated after construction with native vegetation. None of the CIP projects would have a significant long-term adverse impact on the wildlife within the Basins. Restoration of up to 1,000 linear feet of riparian area along Hylebos Creek would be a positive impact on wildlife.

The Basin Plan includes proposed measures to restore stream habitat in the Hylebos Basin. Coordinate stream restoration projects could increase riparian area vegetation, which would improve wildlife habitat. Removal of invasive plant species during restoration projects could displace wildlife in the short term, but would positively improve wildlife habitat in the long-term. No significant adverse environmental impacts on wildlife would occur under the Proposed Action.

No Action Alternative

Development would generally continue at the varied densities currently seen within the Hylebos and Browns-Dash-Point Basins. Major changes in the wildlife habitat resulting from long-term development in the basins would not likely occur, except in areas with the greatest potential for growth. Less riparian vegetation and wildlife habitat would be actively restored under this alternative, because of the lack of a coordinated restoration program. Given the lesser focus on riparian habitat and invasive species under the No Action Alternative, the No Action Alternative would pose a potential for significant impacts on Wildlife.

No significant impacts on wildlife have been identified as resulting from the No Action Alternative.

8.3.5 Land and Shoreline Use

Affected Environment

The land and shoreline uses of the Browns-Dash Point and Hylebos Basis are characteristic of an urbanizing area. Land and shoreline uses in the Browns-Dash Point Basin are generally more developed than in the Hylebos Basin. Land use and buildable lands are discussed in greater detail in *Chapter 4* of the Basin Plan.

Land use in the Browns-Dash Point Basin study area has long been residential. The Browns-Dash Point Basin study area is located within the County Urban Growth Area. The study area is primarily zoned moderate density, single-family residential, with a small area of mixed use for a neighborhood center (*Figure 4-3* of the Basin Plan). Actual land use is approximately 56 percent residential (*Figure 4-4*). The Basin is approaching full build-out with the highest levels of development along the shorelines. Inland, there are larger tracts of land that may ultimately be developed. However, these parcels tend to include steep slopes, streams and other environmental constraints that will delay or possibly preclude their development.

Figure 4-5 of the Basin Plan is a map of buildable lands in the Browns-Dash Point Basin study area. As can be seen from the map, large areas (approximately 57 percent of the study area) of the basin are developed (see *Table 4.2* of the Basin Plan). The undeveloped area includes a large area abutting the King County border that is designated as vacant, but is likely part of the Dash Point State park. This area accounts for approximately 17 percent of the study area. If this area were to remain vacant, the amount of developable land is much less than 57 percent. In addition, using the assumptions developed for the 2002 Buildable Lands Report (Tables 6 - Pierce County and Table 8 - Pierce County of the report), of the remaining developable land area (approximately 40 percent of the study area), less than half (approximately 40 percent) is actually available for development. The rest is unavailable due to constraints such as critical areas, road and right of way construction, and public facilities.

The Hylebos Basin study area also is located within the County Urban Growth Area. The study area is zoned primarily single-family residential, with small areas of mixed-use and commercial activity (*Figure 4-10* of the Basin Plan). Actual land use is approximately 57 percent residential *(Figure 4-11)*. The Fife Heights area has a number of larger tracts of land that are not yet developed to full zoning density. Portions of the undeveloped area include steep slopes, streams, and other environmental constraints that could preclude their development.

Figure 4-12 of the Basin Plan is a map of buildable lands in the Hylebos study area (Pierce County Buildable Lands Report, 2002). As can be seen from the map, approximately 58 percent of the study area is vacant or underdeveloped (see also *Table 4-2* of the Basin Plan). Using the assumptions developed for the 2002 Buildable Lands Report, of the remaining developable land area, less than half is actually available for development (approximately 40%). The rest is unavailable because of constraints such as critical areas, road and right-of-way construction, and

public facilities. The County expects to see continued residential construction activity in the Fife Heights area as the study area builds out.

Land use activities in Pierce County are guided by the Pierce County Comprehensive Plan (Comprehensive Plan). The Comprehensive Plan was developed and adopted in 1995 pursuant to the requirements of the Washington State Growth Management Act (GMA) (Revised Code of Washington Chapter 36.70A). The GMA requires consistency between other planning documents, such as basin plans, and the Comprehensive Plan prepared under RCW 36.70A.

Significant Impacts and Mitigation Measures

Proposed Action (Basin Plan)

Implementation of the Basin Plan would not be expected to significantly affect land or shoreline use in the Browns-Dash Point and Hylebos Basins. No unavoidable significant adverse impacts or cumulative impact on land use are expected to result from implementation of the Basin Plan. The Proposed Action would address many of the identified flooding, drainage, and water quality problems, which would result on long-term indirect benefits on associated land and shoreline uses, compared with the No Action Alternative.

Land use decisions drive stormwater management infrastructure needs. The Basin Plan has used adopted Pierce County land use/zoning and current development regulations to model future hydrological conditions and to determine the type, size, and location of proposed facilities that would be needed to support planned growth. Critical areas designations also have been used to identify potential sites for stormwater facilities and habitat restoration.

The Basin Plan would provide facilities and services that are supportive of land use activities and that are consistent with adopted Pierce County policies and regulations for land use, public facilities, and resource protection. In addition to recommendations for facility construction, the Basin Plan includes recommendations for program development and policy and regulatory changes that would serve to further consistency with the Comprehensive Plan.

Development of stormwater facilities would be consistent with adopted policies and regulations. The Basin Plan therefore would be consistent with of the Pierce County Comprehensive Plan and its policies. Development would be directed away from floodplains and valuable habitat resources towards areas with fewer constraints.

In addition, information contained within the Basin Plan and its supporting documentation provides the "science" needed to support decisions made with regard to land use regulation or policy. The Basin Plan information would guide and/or support development of land use plans that reduce impacts on water resources and public safety.

No Action Alternative

The No Action Alternative has been developed from the 1991 Plan and is a continuation of the existing program. Project recommendations within the 1991 Plan were based upon the needs foreseen in 1991 and upon the land use designations and comprehensive plan policies in effect at that time.

Stormwater facility development would be consistent with adopted policies and regulations and with the 1991 Plan. Because the 1991 Plan was prepared before the Pierce County Comprehensive Plan, stormwater facilities under the 1991 Plan (No Action) would be inherently inconsistent with the currently adopted Comprehensive Plan. The No Action Alternative would continue that inconsistency.

The No Action Alternative would not address many of the identified flooding, drainage, and water quality problems, and would not result in the associated long-term land use and shoreline benefits compared with the Proposed Action. Because of the continued impacts on water quality and the inconsistencies with the Comprehensive Plan, potential significant impacts on land and shoreline use could occur under the No Action Alternative.

8.3.6 Aesthetic, Historic, and Cultural Resources

Affected Environment

The Browns-Dash Point and Hylebos Basins contain several aesthetic views of both natural and manmade features, particularly those properties that overlook the Puget Sound and other water bodies. Several areas of the bluffs overlooking the Sound are designated as Open Space Corridors by Pierce County. The Basins also include several parks and natural areas, which provide views and open space. The major parks and natural areas include the Browns Point Lighthouse Park, Browns Point Playfield, Dash Point Park and Beach, Dash Point State Park, North Shore Golf Club, and the Hylebos Creek wetlands.

The Browns-Dash Point and Hylebos Basins contain relatively new, urbanizing development, with limited potential for historic properties. The Pierce County Register of Historic Places was searched, and no historic resources are identified in the Basins. In addition, the Pierce County Cultural Resources Inventory was searched for properties within the Browns-Dash Point and Hylebos Basins. The two cultural resources identified in the Basins are the Golden Rule Hotel and a house, both of which are located in Fife.

Significant Impacts and Mitigation Measures

Proposed Action (Basin Plan)

The Basin Plan includes a collection of recommendations to manage stormwater within the Browns-Dash Point and Hylebos Basins. Many of these programmatic recommendations include regulatory action, stormwater BMPs, studies, and public education programs, which would likely not affect aesthetic, historic, or cultural resources in the Browns-Dash Point and Hylebos Basins. None of the CIP projects would adversely affect the identified cultural and historic resources. The CIP projects and programmatic recommendations would not result in significant long-term impacts on aesthetic, historic, or cultural resources.

The proposed CIPs include a list of specific projects that would involve some type of construction activity. Construction activity could result in temporary aesthetic impacts associated with tree/vegetation removal. Any short-term construction impacts would be minimal. Disturbed areas would be restored and revegetated after construction. Stream and riparian habitat restoration would add vegetation alongside water bodies and would improve the aesthetic views of those areas. As a mitigation measure, revegetation would use native vegetation where possible. No impacts on park views are expected.

The potential exists to encounter cultural resources during construction of individual projects. If any cultural resources were discovered during construction activities, Pierce County would immediately consult with the Washington State Office of Archaeology and Historic Preservation (OAHP) in Olympia and other appropriate officials regarding mitigation measures. Potential mitigation measures would include conduction investigations of cultural resources that could be affected on each project site, and identifying appropriate mitigation prior to proceeding with any work that could adversely affect cultural resources.

No Action Alternative

Under the No Action Alternative, stormwater would continue to be managed in Browns-Dash Point and Hylebos Basins as it is today. If any cultural resources were discovered during construction of projects within the 1991 Plan, the County would immediately consult with OAHP and other officials regarding appropriate measures. No long-term impacts on aesthetic, historic, or cultural resources would be expected under No Action. Construction activity could result in temporary aesthetic impacts from removing vegetation, while disturbed areas would be restored after construction.

8.3.7 Public Services and Utilities

Affected Environment

All typical public services and facilities are available within the Browns-Dash Point and Hylebos Basins. Portions of the Basins are connected to the Pierce County sanitary sewer system, and are within the Tacoma Treatment Plant Sewer Service Planning Area. The Dash Point area is largely unsewered, however, and the septic systems contribute to water quality concerns (see *Section 8.3.1*, Water Resources, above).

Stormwater facilities are constructed and maintained by Pierce County Water Programs. Facilities such as culverts within County road rights-of-way are maintained by the Transportation Services Division of Public Works and Utilities. County roads are maintained by the County. Major State roads in the area are State Routes 509 and 99, and Interstate 5. Pierce Transit provides bus service.Regional recreational facilities include the Browns Point Lighthouse Park, Browns Point Playfield, Dash Point Park and Beach, North Shore Golf Club, and the Dash Point State Park. Public schools are provided by the Tacoma, Fife, and Puyallup School Districts. Law enforcement services are provided by the Pierce County Sheriff's Department.

Significant Impacts and Mitigation Measures

Proposed Action (Basin Plan)

The Basin Plan includes a series of CIP projects and programmatic measures to reduce flooding and drainage problems. Implementation of the proposed projects and programs would improve long-term public safety and reduce the need for some public services, compared to the No Action Alternative. The decreases in flooding of roadways and properties, landslides, and demand for emergency services would be a positive benefit. The Basin Plan would have no impact upon solid waste collection or landfills, electrical power, natural gas, or telecommunications facilities. Long-term impacts on public services and utilities are not expected under the Proposed Action.

Construction of some of the CIP projects could have short-term impacts upon public safety. Construction of individual CIP projects may temporarily affect local roadways and disrupt local services and utilities. Pierce County would coordinate mitigation measures with local service providers and utilities to avoid or reduce impacts during construction.

No Action Alternative

Public safety and the need for some public services would be minimally improved. Limited upgrades under the 1991 Plan would reduce some of the existing flooding and drainage problems, although at a lesser extent than the Proposed Action. Areas within the Basins would continue to experience localized flooding, which could cause road closures and potentially reduce access for emergency vehicles. Under the No Action Alternative, construction of individual projects under the 1991 Plan could result in short-term construction impacts that could temporarily delay emergency vehicles and disrupt service providers.

No other impacts to Public Services and Utilities are expected.

Written Comments

Leslie Ann Rose
Senior Policy Analyst
Citizens for a Healthy Bay
May 2, 2006

CHB

CITIZENS FOR A HEALTHY BAY

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Tacoma, WA 98402
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chb@healthybay.org
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May 2, 2006

Adonais Clark, Senior Planner
Environmental Designee
Pierce County Planning and Land Services
2401 South 35th Street
Tacoma WA 98409-7490

Re: Hylebos – Browns Point – Dash Point Basin Plan

This letter presents remarks from Citizens for a Healthy Bay (CHB) to the document referenced above.

In general, CHB supports the plan and believes its implementation will improve the overall environmental quality of the Hylebos-Browns Point-Dash Point basin. CHB does note a serious omission in the Supplemental EIS, specifically Section 8.3.4 Wildlife - Significant Impacts and Mitigation Measures.

The Supplemental EIS does not adequately acknowledge raptor habitat and active raptor nests documented within the basin, most seriously fails to address the potential adverse impacts to two active and successful Bald eagle nests. Eagles and other raptors rely on the basin habitats for foraging year round. Additionally, lower Hylebos Creek provides nesting habitat for migrating seabirds including Merganser and Harlequin duck. Construction and basin improvements must protect these nesting, roosting and foraging habitats without displacing the raptors and seabirds dependent upon them, especially during sensitive nesting and rearing seasons.

Thank you for your consideration of our remarks.

Sincerely:

Leslie Ann Rose

Leslie Ann Rose
Senior Policy Analyst

Leslie Ann Rose
Senior Policy Analyst
Citizens for a Healthy Bay
May 2, 2006

RESPONSE: Thank you for your letter and comments. The FSEIS text has been amended to address your comments.

Please note that any projects that are undertaken pursuant to the adopted Plan will be subject to additional review. The review for specific projects may vary, but is likely to include SEPA review, Shoreline Management Act review, and Critical Area review under Pierce County Code Chapter 18E in addition to review for compliance with state and federal regulations.

Sheri J. Tonn
May 1, 2006

7311 East Side Drive NE
Tacoma, WA 98422
May 1, 2006

Adonais Clark
Environmental Designee
Pierce County Planning and Land Use Services
2401 South 35th Street, Suite 175
Tacoma, WA 98409

Dear Mr. Clark:

Re: Draft Supplemental Environmental Impact Statement for the Proposed Hylebos Browns-Dash Point Basin Plan

I have reviewed the Basin Plan and associated DEIS, and have two concerns related to the proposed projects, during and after construction. They are:

1. The plan briefly identifies wild life species, but does not address concerns related to raptors. Active raptor nests should be identified, and construction should not take place while raptor nests are active. There are at least two mapped bald eagle nests in the identified project area. One is very close to Site BDP-4, the Dry Gulch and Varco project, probably within a few hundred feet of the Dry Gulch. Federal standards regarding tree trimming and removal should be identified in the FIES and applied to this and other construction projects.

2. Surface water is vital to the survival of wildlife. Historically, small seasonal streams drained the basin. Where possible, ditches should be opened and habitat quality improved, rather than increasing the length of culverts. From individual project descriptions, it is not clear where culverts will be extended, or how wildlife habitat will be improved. The FEIS should specify this for all high and medium priority projects.

Thank you for the opportunity to provide comments on these projects.

Sincerely,

Sheri J. Tonn

Sheri J. Tonn
May 1, 2006

RESPONSE: Thank you for your letter and comments. Please see also response to comments from Citizens for a Healthy Bay. Project descriptions within the Basin Plan are at a conceptual level for planning purposes. Whether a culvert will be lengthened or a ditch opened is a matter that will be subject of additional consideration when actual project scoping and design commence. Habitat and mitigation factors are also investigated more fully at those stages of project development.

Department of Ecology
Southwest Regional Office
April 29, 2006

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47775 • Olympia, Washington 98504-7775 • (360) 407-6300

April 26, 2006

Mr. Adonais Clark, Environmental Designee
Planning and Land Services Department
Pierce County
2401 South 35th Street, Room 175
Tacoma, WA 98409

Dear Mr. Clark:

Thank you for the opportunity to comment on the Draft Environmental Impact Statement for the Hylebos Browns-Dash Point Basin Plan, as proposed by Pierce County Public Works and Utilities, Water Programs Division. The Department of Ecology (Ecology) reviewed the environmental checklist and has the following comment(s):

TOXIC CLEANUP: Marv Coleman (360) 407-6259

This area may have been contaminated with heavy metals due to the smokestack plume originating from the old Asarco Smelter in North Tacoma. Ecology recommends that the soils be sampled and analyzed for lead and arsenic. Erosion control measures must be in place prior to any clearing, grading, or construction. These control measures must be effective to prevent soil from being carried into surface water by stormwater runoff. Sand, silt, and soil will damage aquatic habitat and are considered pollutants. Any discharge of sediment-laden runoff or other pollutants to waters of the state is in violation of Chapter 90.48, Water Pollution Control, and WAC 173-201A, Water Quality Standards for Surface Waters of the State of Washington, and is subject to enforcement action.

Proper erosion and sediment control practices must be used on the construction site and adjacent areas to prevent upland sediments from entering a stream channel, water body or natural stormwater drainage system. If these contaminants and/or others are found at concentrations above the Model Toxics Control Act (MTCA) cleanup levels, Ecology recommends that current owners, potential buyers, construction workers, and others be notified of their occurrence and that you contact the Environmental Report Tracking System Coordinator at the Southwest Regional Office at (360) 407-6300.

For assistance and information about subsequent cleanup and to identify the type of testing that will be required contact Marv Coleman at (360) 407-6259 or Joyce Mercuri at (360) 407-6260.

Ecology's comments are based upon the information provided with the SEPA checklist. As such, they do not constitute an exhaustive list of the various authorizations that must be obtained or legal requirements that must be fulfilled in order to carry out the proposed action.

If you have any questions or would like to respond to these comments please contact the appropriate reviewing staff listed above.

Department of Ecology
Southwest Regional Office

(DN: 06-2483)

cc: Marv Coleman, TCP
Joyce Mercuri, TCP
Dan Wrye, Pierce County Water Programs

Department of Ecology
Southwest Regional Office
April 29, 2006

RESPONSE: The potential presence of contaminants is addressed in Chapter 4 of the Basin Plan. Your comments have been noted. Thank you.

Dan and Jill Barkley
April 27, 2006

April 27, 2006

To: Mr. Adonais Clark, Environmental Designee
Pierce County Planning and Land Services Department
2401 South 35th St.
Tacoma, WA 98409

Re: Draft Hylebos Browns-DASH POINT Basin Plan and Draft Supplemental Environmental Impact Statement

We live at 6602 Spring Street, and we do not remember receiving a comment survey in 2004, nor does it appear that our street is in the comment area mapped in the recent EIS Draft. It may be that we just missed it during the busy summer month of July.

We would like to comment on Spring Street in Dash Point. The remedy proposed to prevent further erosion is welcomed, but does not address the floods of water that flow from above Dogwood Street and down 21st Street and Dash Point Boulevard ending up under the road culvert on Spring Street. There is so much water at times, that we have been mudded inside our house a few times, when we fail to check all of the catch basins prior to the downpours! One time plastic newspaper tubes blocked a culvert, and eroded our banks, spewed mud into our home and filled our neighbor's garage! Another time a neighbor left his laurel clippings in the open ditch, they floated to the culvert opening, and again, we were mudded! There is also a problem of rogue water not making it into the ditch, it flows over our driveway bump, and erodes the underneath of our driveway on Dogwood Street. Our rock walls crumble from the excess water! We get all of the uphill runoff down here on the inside corner of Spring Street. We look forward to dry summer!

The only family now putting yard waste across the road live at 8633 East Side Drive NE. They do not own the property, nor do they have permission to dispose onto the property. Since the dawn of recycle bins for yard waste in our area, dumping has nearly ceased. There is one washing machine in the gully under the debris that was too heavy to pull out.

The open ditch on the south side of Spring Street abutting our land, has overgrown with bamboo grass, blackberry, and other weeds, and continues to deepen yearly. There is no riprap at the culvert entrance and our fence and sport court is suffering from under the bank erosion. Our overgrown ivy holds it all together, and we try to keep it back from the ditch.

Please address the issue of water runoff from up-hill, prior to its finding its way down to the Spring Street culvert. Thank you for listening!

Jill Barkley Jill Barkley 4/27/06
Dan Barkley Dan Barkley 4/27/06
6602 Spring St NE
Tacoma, WA 98422

Dan and Jill Barkley
April 27, 2006

RESPONSE: Thank you for your comments. Your concerns are noted. Some of them appear to be related to maintenance issues. Those comments will be forwarded to our maintenance section for investigation. Our proposed project "CIP01-BDP1-CP01" will also address some of your concerns. At this time the design is conceptual for planning purposes. When the project scoping and actual design for construction are undertaken, the project will be designed to more specifically address known problems.

Comments Received at Public Meetings

Two public presentations were conducted for the Draft Basin Plan. Notice of the presentations was included in the published Plan document, and was sent to all parties who had attended previous public meetings or were on the interested parties mailing list. Notice was also posted on the Water Programs website.

April 18, 2006
Fife Community Center
2:00 p.m.

One interested party, a commissioner for Drainage District 23, attended the open house/meeting. The locations of some drainage ditches within the District were not shown. He also expressed concern about the increase in water that enters the District systems. The increase appears to be related to increased development in the area. The system is at the downstream end of the drainage basin, and receives water from outside district boundaries. The District is responsible under NPDES for discharges from the system, but has little control over what is coming into it.

The commissioner also noted that some of the priority ratings in the project tables did not match those in some of the project descriptions.

Response: The hydrology shown on the figures was based upon GIS coverages for water resources that were available during Plan preparation. A figure has been created that reflects more recent GIS coverages for drainage features within the District area. Please see "Figure 8a."

We acknowledge your concerns about drainage from outside the District boundaries. New development within unincorporated Pierce County is subject to the provisions of the Pierce County Stormwater Management and Site Development Manual which contains standards developed to reduce municipal liability related to control of stormwater runoff.

We have corrected the inconsistencies in the ratings between the tables and the Plan text.

Thank you for providing comment.

April 19, 2006
Browns Point Improvement Club
7:00 p.m.

Three citizens attended this meeting. Part of their interest was because there is a proposed community plan underway in the Browns-Dash Point area. A question was raised about the population projections within the Basin Plan—did they represent just the unincorporated area? (Staff confirmed later that they did, and provided the information to interested parties.)

There was support for the area-specific proposed programmatic measures to address water quality concerns. Attendees were familiar with the problems sites contained within the Plan and expressed that the Plan seemed to address area concerns regarding storm drainage and surface water management problems. They asked that Water Programs coordinate with Planning and Land Services for development of the community plan.

Response: Thank you for your interest in our Basin Plan. We will add language to the Basin Plan text to clarify that the projections are specific to the unincorporated area of Pierce County.

We will coordinate with Planning and Land Services as appropriate during development of the community plan.

DISTRIBUTION LIST

BASIN PLAN RECIPIENTS

Kobetich Branch, Tacoma Public Library

Fife Community Center

Puyallup Tribe of Indians

Puyallup Indian Tribal Fisheries

Browns Point Improvement Club c/o Jason Water, President

Puyallup River Watershed Council c/o Linda Burgess, Chair

Drainage District 23

Washington State Department of Ecology

Pierce County Library Headquarters

Dan and Jill Barkley

Sheri Tonn

Citizens for a Healthy Bay

NOTICE OF AVAILABLITY RECIPIENTS

City of Tacoma

City of Fife

City of Federal Way

City of Milton

City of Edgewood

Tacoma Public Library Headquarters

Friends of the Hylebos

Washington State Department of Transportation

Drainage District 21

Washington State Department of Fish and Wildlife

APPENDIX A

GLOSSARY

Glossary of Terms Used

100-Year Flood, a.k.a. Base Flood	The flood having a one-percent chance of being equaled or exceeded in any given year
303(d) List	Section 303(d) of the federal Clean Water Act requires Washington State periodically to prepare a list of all surface waters in the state for which beneficial uses of the water – such as for drinking, recreation, aquatic habitat, and industrial use – are impaired by pollutants. These are water quality limited estuaries, lakes, and streams that fall short of state surface water quality standards, and are not expected to improve within the next two years.
4(d) Rule	In the federal Endangered Species Act, the protective rule promulgated by the lead federal agency at the time it makes a final decision to list a species as threatened. The 4(d) Rule can be a restatement of Section 9(a) prohibitions on take of a species, but also can specify activities which have been determined to be adequately regulated and given legal coverage for the (incidental take) of the listed species.
Aquatic	Pertaining to water
Aquifer	A saturated permeable material (often sand, gravel, sandstone, or limestone) that contains and carries groundwater and acts as a water reservoir.
A-Zone	The areas inundated by the 100-year flood.
Backwater	Stream water, obstructed by some downstream hydraulic control, that is slowed or stopped from flowing at its normal, open-channel flow condition.

Bankfull Discharge	Sometimes referred to as the effective flow or ordinary high water flow; it is the channel-forming flow. For most streams, the bankfull discharge is the flow that has a recurrence interval of approximately 1.5 years. Most bankfull discharges have a recurrence range between 1.3 and 1.8 years. In some areas it could be lower or higher than this range. Bankfull discharge is the flow that transports the most sediment for the least amount of energy.
Base Flood	The flood having a one percent chance of being equaled or exceeded in any given year, also referred to as the "100-year flood" The base flood surface water elevation is measured in feet above mean sea level and referenced to the National Geodetic Vertical Datum of 1929 (or the most current vertical datum accepted by Pierce County.
Base Flood Elevation (BFE)	Water surface elevation of the base flood (100-year flood); the elevation which is the basis of the insurance and floodplain management requirements of the National Flood Insurance Program.
Base Flow	The portion of the stream flow that is not due to storm runoff and is supported by groundwater, large lakes, and swamp seepage into a channel
Basin	A geographic and hydrologic sub unit of a watershed, shortened reference to drainage basin
Best Management Practices (BMPs)	Physical, structural, or managerial practices which have gained general acceptance for their ability to prevent or reduce environmental impacts.
BMPs	See Best Management Practices.
Buffer	"Buffer" means a tract or strip of land that separates one type, category or use of land from another. Buffers typically serve to provide a defined area between a more intensive use of land and a land use that is less intensive. Buffers are typically referenced by the associated critical area such as wetland buffer, riparian buffer, etc.

B-Zone	Certain areas subject to the "base flood" with contributing drainage areas of more than 100 acres and less than one square mile and all pothole areas
Capital Improvement Project (CIP)	A project funded by Pierce County Water Programs intended to improve the physical plant of the drainage system, the performance of that system, and/or reduce site specific or cumulative adverse stormwater impacts
Carrying Capacity	The level of development density or use an environment is able to support without suffering undesirable or irreversible degradation
cfs	Cubic feet per second. Units assigned to the volume of water that flows past a fixed point in a stream channel, drainage outlet or other water flow path every second; equivalent to 449 gallons per minute (gpm)
Channel	"Natural or artificial waterway of perceptible extent that periodically or continuously contains moving water. It has a definite bed and banks that serve to confine water."
Channel Erosion	The widening, deepening and headward cutting of small channels and waterways due to erosion caused by moderate to large floods
Channel Morphology	The shape and gradient of a channel that forms due to streamflow forces and the composition of the underlying channel substrate.
Channelization	The straightening, deepening, or widening of a stream channel for the purpose of increasing the stream's carrying capacity
Clearing	The removal of timber, brush, grass, ground cover, or other vegetative matter from a site, which exposes the earth's surface on the site
Confluence	The location where two streams meet.
Conservation	Includes protection, maintenance and restoration of habitat characteristics to support the species of interest

Consistency	No feature of a plan or regulation is incompatible with any other feature of a plan or regulation *(WAC 365-195-210)*
Contaminant	Any chemical, physical, biological, or radiological substance that does not occur naturally or occurs at concentrations and duration as to be injurious to human health or welfare or shown to be ecologically damaging
Conveyance Capacity	A term generally referring to the maximum capability of the physical drainage system to safely transport water (from a hydraulic perspective)
Corridor (Landscape)	Landscape elements that connect similar patches of habitat through an area with different characteristics; for example, streamside vegetation may create a corridor of willows and hardwoods between meadows or through a forest.
Critical Areas	Wetlands, flood hazard areas, fish and wildlife habitat areas, aquifer recharge areas, and geologically hazardous areas
Culvert	A single length of pipe open to the ground surface at both ends carrying streamflow under a road grade or other type of fill embankment. Typically, no manholes or catch basins are installed along its length.
Degradation	The lowering of the streambed or widening of the stream channel by erosion. The breakdown and removal of soil, rock and organic debris.
Detention Facility	A facility (e.g., pond, vault, pipe) in which surface and stormwater are temporarily stored and released at a controlled rate
Development	Any man-made change to improved or unimproved real estate including, but not limited to: buildings or other structures, placement of manufactured home/mobile home, mining, dredging, clearing, fillings, grading, paving, excavation, drilling operations, or the subdivision of property.

Development Regulations	Any controls placed on development or land use activities by a county or city, including, but not limited to, zoning ordinances, subdivision ordinances, and binding site plan ordinances *(RCW 36.70.030)*
Discharge	Flow rate of a stream or stormwater system, usually measured in cubic feet per second
Drainage Inventory	Data on public storm drainage system describing type, size, and location of facilities.
Easement	The legal right to use a specified piece of land for a particular purpose.
Ecosystem	A biological community together with the chemical and physical environment with which it interacts.
Effectiveness Monitoring	The evaluation of whether an action achieved the desired effect. For example, in a sediment reduction project, effectiveness monitoring would determine whether sediment supply was actually reduced.
Ephemeral Stream Channel	A dry stream course, except during or immediately after extreme rainfall or surfacing groundwater due to heavy annual rainfall; often no ordinary high water mark is evident. See also intermittent stream channel.
Erosion	Detachment of soil or rock fragments by water, wind, ice and gravity
Erosion & Sedimentation Control Facility	A type of drainage facility designed to hold water for a period of time to allow sediment contained the surface and stormwater runoff directed to the facility to settle out and improve the quality of the runoff
Fecal Coliform	Minute living organisms associate with human or animal feces that are used as an indirect indicator of the presence of other disease causing bacteria
Federal Emergency Management Agency (FEMA)	Independent agency created in 1978 to provide a single point of accountability for all federal activities related to disaster mitigation and emergency preparedness, response and recovery

Fill	Earth, sand, gravel, rock, asphalt, or other solid material placed to raise the ground elevation or to replace excavated material
Fish & Wildlife Habitat Areas	The areas identified as being of critical importance to maintenance of fish, wildlife, and plant species, including: areas with which endangered, threatened, and sensitive species have a primary association; habitats and species of local importance; commercial and recreational shellfish areas; kelp and eelgrass beds, herring and smelt spawning areas; naturally occurring ponds under twenty acres and their submerged aquatic beds that provide fish or wildlife habitat; waters of the state; lakes, ponds, streams, and rivers planted with game fish by a governmental or tribal entity, or private organization; state natural area preserves and natural resource conservation areas.
Fish Passage Barrier	An obstacle that prevents fish from moving either upstream or downstream, such as certain dams, weirs, floodgates, roads, bridges, causeways and culverts.
Flood	An overflow or inundation that comes from a river or any other source, including but not limited to streams, tides, wave action, storm drains, or excess rainfall.
Flood Control	Physically controlling a river or stream by structural means such as dikes and levees, which separate people and property from damaging floodwater
Flood Elevation	Height of flood waters above an elevation datum plane
Flood Hazard Management	A comprehensive approach to flood control issues that encompasses both flood control management and floodplain management and uses both structural and nonstructural methods of reducing flood hazards. Flood hazard management is not limited to areas within the floodplain but can extend to the entire watershed. Stormwater management is also included because the control of the quantity and quality (sediment load) of stormwater runoff into streams and rivers can have significant impacts on stream and river flooding.
Flood Insurance Rate Map (FIRM)	"Flood Insurance Rate Map (FIRM)" means the official map on which the Federal Insurance Administration has delineated areas of special flood hazard and the risk premium zones applicable to Pierce County.

Flood prone Area	Generally includes the active floodplain and the flood fringe. The elevation of the flood prone area is qualitatively defined as 2 times the bankfull depth.
Flooding or Erosion Impacts	Impacts such as flooding of septic systems, crawl spaces, living areas, outbuildings, etc.; increased ice or algal growth on sidewalks/roadways; earth movement/settlement; increased landslide potential; erosion and other potential damage
Floodplain	The total area subject to inundation by the base flood including the flood fringe and floodway. The low area adjoining a stream or river channel that overflows at times of high river flow.
Geomorphology	The actions or events that shape and control the distribution of materials, their states and their morphology within the interior and on the surface of the earth
Glacial Till	Surface or near-surface soil that has been compressed by a past glacier into a dense, relatively impermeable material. It typically has a low infiltration rate and is often responsible for the formation of ponds, wetlands or a seasonally high water table.
Gradient (of stream)	Degree of inclination of a stream channel parallel to stream flow; it may be represented as a ratio, fraction, percentage or angle.
Groundwater	The water contained in interconnected pores located below the water table in an unconfined aquifer or located in a confined aquifer
Groundwater Flooding	The occurrence of surface and subsurface water resulting in flood inundation, due to the fluctuation of the water table. It encompasses depth, frequency, and duration and is usually seasonal by characteristic.
Habitat	The sum total of all the environmental factors of a specific place that is occupied by an organism, a population or a community.
Hazard Mitigation	Action taken to reduce or eliminate long-term risk to people and property from hazards such as floods, earthquakes and fires

High Gradient Contained	Moderately to deeply incised channels with high stream power. Most sediment is easily transported, thus gravel and small cobbles deposit only in hydraulically protected areas. Pools tend to be small and shallow, although LWD and bedrock may form large deep pools.
Hydraulic Project Approval	Permit issued by Washington State Department of Fish and Wildlife required for projects with construction activity in or near state waters (RCW 75.20.100-160) that affect the bed or flow of a stream.
Hydrograph	A graph showing variation in the flow in a stream or channel, over time, at a specified point of interest
Hydrologic Soil Group	A classification of soils by the Soil Conservation Service into four runoff potential groups. The groups range from A soils, which are very permeable and produce little runoff, to D soils, which are not very permeable and produce much more runoff
Hydrology	The science of the behavior of water in the atmosphere, on the surface of the earth, and underground.
Illicit Discharge	All non-stormwater discharges to stormwater drainage systems that cause or contribute to a violation of State water quality, sediment quality or ground water quality standards.
Impervious Surface	A hard surface, which either prevents or retards the entry of water into the soil mantle as under natural conditions prior to development, and/or a hard surface area, which causes water to run off the surface in greater quantities or at an increased rate of flow than the flow present under natural conditions prior to development. Common impervious surfaces include, but are not limited to, roof tops, walkways, patios, driveways, parking lots or storage areas, concrete or asphalt paving, gravel roads, gravel parking lots, packed earthen materials, and oiled, macadam or other surfaces which similarly impede the natural infiltration of stormwater.
Incised Channel	A stream channel in which the bed has dropped and as a result, the stream is disconnected from its floodplain

Infiltration Facility	A drainage facility designed to use the hydrologic process of surface and stormwater runoff soaking into the ground, commonly referred to as percolation, to dispose of surface and stormwater runoff
Instream Flow	Instream flow is the amount of water in a stream required to support or protect existing uses of fish and fish habitat.
Intermittent Stream Channel	Stream channels that carry water consistently for part of the year and are dry during the remainder of the year. See ephemeral stream channel
Landscape	All the natural features such as grasslands, hills, forest and water, which distinguish one part of the earth's surface from another part; usually that portion of land that the eye can comprehend in a single view, including all its natural characteristics
Large woody debris (LWD)	Any piece of woody material generally 12 inches or larger in diameter that intrudes into a stream channel or nearby (e.g., logs, stumps or root wads) and that functions to form pools, regulate sediments, disperse stream energy, create channel complexity, stabilize channels, provide instream organic matter, and provide cover for fish.
Low Impact Development (LID)	A category of best management practices designed to incorporate open space preservation techniques, such as cluster residential developments or rooftop runoff management, foundation design, vegetation enhancement, etc., that reduce hydrological impacts of development, as compared to more traditional practices
Main Stem	The principal channel of a stream to which tributaries join.
Meander Pattern	A series of sinuous curves or loops in the course of a stream that are produced as a stream swings from side to side in flowing across its floodplain
Minor Drainage System	The convenience drainage system consisting of street gutters, storm sewer, small open channels, and swales, etc.

Mitigation	Avoiding, rectifying, minimizing, reducing, compensating for or eliminating probable significant adverse impacts to a natural resource or environment.
Model	Models are conceptual and mathematical descriptions or analogies used to help visualize something that cannot be directly observed. Models provide frameworks that organize concepts, data and information into a system of inferences that can be presented as mathematical descriptions of situations or state of affairs.
Moderate Gradient Contained	Transport dominated channels with moderate to high stream power. LWD is important for forming pools and storing sediment, thus substrates and bedforms are highly variable. Off-channel habitats are rare.
Native	Occurring naturally in a habitat or region; not introduced by humans
NPDES	National Pollutant Discharge Elimination System
On-Site Detention	Temporary storage of runoff on the same land development site where the runoff is generated, frequently as a condition for development activity
Open Space	A landscape which is primarily unimproved. Open space areas may include: critical areas, wooded areas, and parks, trails, privately owned natural reserves, abandoned railroad lines, utility corridors, and other vacant rights-of-way. Permanent dedications, designation, or reservation of open space for public or private use may occur in accordance with Comprehensive Plan policies. Open space may include Natural Open Space, Natural Buffer Areas, Buffers, and Screening.
Organics	Organics is a collective term for any number of carbon-based substances that may be toxic to aquatic life or can accumulate in fish tissue to levels that are unsafe for human consumption.
Outfall	The outlet of a storm drain or sewer. The point where water flows from a manmade conduit, channel, or drain into a water body or other natural drainage feature

Palustrine	Wetland channels, beaver complexes or sloughs. Velocity is generally low, substrates are composed of fine sediment or organic matter, and channel morphology is sinuous or irregular and dominated by pools or glides (*R2 Resource Consultants, 2000*).
Peak Flow	The maximum instantaneous rate of flow during a storm, usually in reference to a specific design storm event
Perennial Stream	A watercourse that flows throughout the year
Pervious	A solid surface that contains a sufficient amount of void space to allow water to infiltrate through it.
Pesticides	Chemical used to kill, control, or manage plant or animal pests; includes herbicides, fungicides, insecticides, rodenticides, and piscicides.
Pollutant Loading	The arithmetic product of the pollutant concentration and the runoff over a specified period of time (day, month, year, etc.)
Pothole	A closed drainage basin from which there is no surface water outlet.
Priority Habitat	A seasonal range or habitat element with which a given species has a primary association and which, if altered, may reduce the likelihood that the species will maintain or increase population over the long term. These might include areas of high relative density, breeding habitat, winter range, and movement corridors. Priority habitats might also include areas that are of limited availability or high vulnerability to alteration, such as cliffs, talus, wetlands, etc.
Priority Species	An animal species of concern due to their population status and their sensitivity to habitat manipulation. Priority species include species of concern, monitor species, candidate species, priority game species, as well as other game and non-game species.
Private Stormwater Facility	Any stormwater system or portion thereof held in private ownership, or the responsibility for operation of which resides with a private entity .

Programmatic	Relating to a plan or procedure for dealing with some matter, e.g., regulations, policy guidelines, site design standards, operational policies and procedures, technical assistance, enforcement, and public outreach and educational programs.
Public Stormwater Facility	Any stormwater system or portion thereof that is owned or operated by a public entity
Reach	A segment of a stream channel where the cross-section, slope and roughness of the channel are constant. Simulation of the flow in streams is done by dividing the stream channel into reaches.
Receiving Waters	Streams, lakes, bays, etc., into which stormwaters are discharged
Reed Canary Grass	An invasive grass that thrives in open, wet areas, often a nuisance plant in riparian and wetland areas
Regional Stormwater Facility	Stormwater detention, retention or water quality control facility designed to manage runoff from large tracts of land (sub-basins)
Restoration	The reestablishment of a viable wetland or critical fish or wildlife habitat area from a previously filled or degraded site
Retention	The holding of runoff in a basin without release except by means of evaporation, infiltration or emergency bypass
Right Of Way (ROW)	A strip of land held in an easement or separate tract which is occupied or dedicated to be occupied by a publicly or privately dedicated street or railroad, together with property reserved for utilities, transmission lines and extensions, walkways, sidewalks, bikeways, equestrian trails, and other similar uses.
Rip Rap	A combination of large stone, cobbles and boulders used to line channels, stabilize banks, reduce runoff velocities or filter out sediment

Riparian Area	"Riparian area" means land areas directly influenced by a body of water. Usually such areas have visible vegetation or physical characteristics showing this water influence. Stream sides, lake borders, and marshes are typical riparian areas. Generally refers to such areas along flowing bodies of water. The term *Littoral* is generally used to denote such areas along non-flowing bodies of water.
Runoff	Water originating from rainfall and other precipitation that si found in drainage facilities, rivers, streams, springs, seeps, ponds, lakes and wetlands, as well as shallow ground water
Salmonids	Fish of the family Salmonidae, including salmon, trout, char (salmon and steelhead stock inventory), whitefish and grayling native to Washington State
Scour	Process by which floodwaters remove soil around objects that obstructs flow, such as the foundation wall of a house, the channel of a stream, or below a culvert
Sediment	Solid material settled from suspension in a liquid
Sedimentation	The process of settling and depositing of suspending matter carried by runoff; usually occurring by gravity when the velocity of the surface water is reduced below the point at which it can transport the suspended material
SEPA	State Environmental Policy Act (RCW 43C)
Sheet Flow	Runoff which flows over the ground surface as a thin, even layer, not concentrated in a channel
Significant Erosion	The removal and transport of sediment, generally by the action of water, in a manner that causes damage to property, aquatic ecosystems, aquatic habitats, salmonids or other aquatic resources

Site Development Standards	A variety of standards applied to site development that can include, among others, principles for placement of buildings on site, provision of open space, access roads, drainage facilities, lighting, parking and landscaping.
Soil Permeability	The ease with which gases, liquids, or plant roots penetrate or pass through a layer of soil
Spawning Habitat	Areas used by adult fish for laying and fertilizing eggs
Stakeholder	Group of people pr organizations with an interest in the outcome of a plan, program, or project.
Storm Drains	The enclosed conduits that transport surface and stormwater runoff toward points of discharge (sometimes referred to as storm sewers)
Storm Sewer	Usually enclosed conduits that transport excess stormwater runoff toward points of discharge (sometimes called “storm drains”)
Stormwater	The portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, channels or pipes into a defined surface water channel, or a constructed facility
Stormwater Management	Management of the quantity, quality and conveyance of surface water runoff from precipitation
Stream	A channel of perennial or intermittent flowing water
Stream Geomorphology	The study of the riparian landscape and its affect on stream flow patterns. The landscape tends toward a dynamic equilibrium state where stream flow patterns are affected by the landscapes (or streambeds) ability to erode or resist erosion.
Sub-basin	A drainage area which drains to a watercourse or water body named and noted on common maps and which is contained within a basin; a basin or area which is part of a larger drainage basin or area.

Substrate	The rock or soil material present in the bottom of the stream or river, including muck, sand, gravel, boulders and bedrock
Sub-Watershed	A geographic drainage unit that combines with other sub-watersheds to form a watershed
Surface Water	"Surface water" means an open body of water that flows or is collected on the earth's surface such as rivers, lakes, reservoirs, ponds, streams, seas, estuaries, etc., and all springs, wells, or other collectors directly influenced by surface water
Surface Waters of the State	Includes lakes, rivers, ponds, streams, inland waters, saltwaters, wetlands and all other surface waters and water courses within the jurisdiction of the state of Washington (WAC Chapter 173-201A).
Swale	A natural depression or wide shallow channel that temporarily stores, routes or filters runoff
TMDL	See Total Maximum Daily Load.
Topography	The shape or configuration of the land, represented on a map by contour lines or relief shading.
Total Maximum Daily Load (TMDL)	A water quality planning and implementation tool required under Section 303(d) of the Clean Water Act. This measure specifies, through the use of a scientifically-based process, the amount of a pollutant that can be discharged to a water body without affecting beneficial uses and mechanisms for ensuring discharges do not exceed that amount. TMDLs can focus on both point and nonpoint sources of pollution and one watershed may have a TMDL developed for both simultaneously.
Total Suspended Solids (TSS)	A measure of the weight of mineral or organic solids suspended in a given volume of water; used as a measure of sedimentation or siltation and as an indicator of pollutants known to attach to solids
Undeveloped	A property in a state generally approaching being native or natural covered with living, mature vegetation

Urban Growth	The growth that makes intensive use of land for the location of buildings, structures, and impermeable surfaces to such a degree as to be incompatible with the primary use of such land for the production of food, other agricultural products, or fiber, or the extraction of mineral resources. When allowed to spread over wide areas, urban growth typically requires urban governmental services. "Characterized by urban growth" refers to land having urban growth located on it, or to land located in relationship to an area with urban growth on it as to be appropriate for urban growth.
Urban Growth Area	Those areas established through the designation of a boundary which separates existing and future urban areas from rural and resource areas. An urban growth area defines where developments will be directed and supported with historical and typical urban governmental services and facilities, such as storm and sanitary sewer systems, domestic water systems, street cleaning services, fire protection services, and public transit services. Urban Growth Areas are established by the Pierce County Comprehensive Plan.
USBEM	Urban Stream Baseline Evaluation Methodology
USGS (United States Geological Survey)	Agency within the federal Department of the Interior responsible for collecting and distributing stream flow data for the nation
Water Body	Surface waters including rivers, streams, lakes, ponds, marine waters, estuaries, and wetlands
Water Quality Standards	Limits for water pollution in lakes, rivers and marine waters in order to protect water quality. The Clean Water Act requires that the water quality standards protect beneficial uses, such as swimming, fishing, aquatic life habitat, and agricultural and drinking water.
Water Resources Inventory Area (WRIA)	An administrative and planning unit in Washington State that encompasses a large river basin
Water Table	The upper level of groundwater or the zone of saturation for underground water. It is an irregular surface with a slope or shape determined by the quantity of ground water and the permeability of the earth material. Also referred to as *Groundwater Tabl*e.

Watercourse Alteration Any man-made change in the alignment, geometric cross-Section, channel capacity, or channel efficiency of a watercourse

Watershed The region drained by or contributing water to a stream, lake, or other body of water.

Weir A dam or obstruction in a stream or river to raise the water level or divert streamflow

Wetland Areas that are inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands generally do not include those artificial wetlands intentionally created from nonwetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities; or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. However, wetlands may include those artificial wetlands intentionally created from nonwetland areas created to mitigated conversion of wetlands.

Zoning The process by which a county or a municipality legally controls the use of property and physical configuration of development upon tracts of land within its jurisdiction. Zoning is an exercise of the police power and as such must be enacted for the protection of public health, safety and welfare. (*PCC Title 19, Appendix A)*

APPENDIX B

1991 PIERCE COUNTY STORM DRAINAGE

AND SURFACE WATER MANAGEMENT PLAN PROJECTS

AND COMPLETION STATUS

Table B-1. Recommended Projects in the 1991 Pierce County Storm Drainage and Surface Water Management Plan

High Priority Projects	Estimated Cost	Project Number	Status	Notes	Basin Plan ID Code
Hylebos Study Area					
Replace 3 County-owned Culverts (because culverts did not meet 25-yr design standard)	$131,000	*HY-CULV-H (HY-HY-5, HY-WP-9, HY-WP-9A)*	Confirmed HY-HY-5 is a problem, but it is now outside County jurisdiction (located in Fife). Status on others not known		H-5
NE of I/S of 16th St. E. and 108th Ave. E. Floodplain Zoning	0 CIP cost	*HY-aDET*	Outside County jurisdiction (located in Edgewood)		
4 ponds N of 24th St. E. & W of 108th Ave. E. Floodplain Zoning	0 CIP cost	*HY-dDET*	Outside County jurisdiction (located in Edgewood)		
S of 36th St. E. & 119 Ave. extended Floodplain Zoning	0 CIP cost	*HY-eDET*	Outside County jurisdiction (located in Edgewood)		
N of 40th St. and east of 122 Ave. E. Floodplain Zoning	0 CIP cost	*HY-gDET*	Outside County jurisdiction (located in Edgewood)		
S of 24th St. E. & E of 112th Ave. E. Floodplain Zoning	0 CIP cost	*HY-hDET*	Outside County jurisdiction (located in Edgewood)		
Near 32nd St. and E of 110th Ave. E. Floodplain Zoning	0 CIP cost	*HY-iDET*	Outside County jurisdiction (located in Edgewood)		
Near I/S of 36th St. E. & 108th Ave. E. Floodplain Zoning	0 CIP cost	*HY-jDET*	Outside County jurisdiction (located in Edgewood)		
Immediately DS of Milton Floodplain Zoning	0 CIP cost	*HY-lDET*	County has acquired some of properties. WSDOT SR 167 work would address flooding in this area.	P-4-CIP-D333	
Surprise Lake Outlet on valley floor, Flood storage/floodproof	$848,000	*HY-oDET*	Outside County jurisdiction (located in Fife)		
In Milton at confluence of forks, flood storage	$320,000	*HY-Milton*	Outside County jurisdiction (located in Milton)		
Floodproof existing structures on Hylebos, floodproofing	$200,000	*HY-floodcontrol*	WSDOT SR 167 work would address flooding in this area.	WSDOT plans to acquire some properties	
Improve water quality from pipelines, Improve 2 pipeline outlets	$93,000	*HY-WQ-H*	Status not known		
Allowance for undefined projects, Misc. Projects	$600,000	*HY-misc*	Status not known		
Browns-Dash Point Study Area					
Erosion Control - Dash Point (priv)/HDPP on a steep slope	$158,000	*TW-proj(k)*	Constructed.	D801 - Markham Ave. Pipeline	

Table B-2. Completed Projects not identified in 1991 Pierce County Storm Drainage and Surface Water Management Plan

Project Number	Project Name	Year Completed
	Hylebos Basin	
CIP-5552	Caldwell Road - Pipeline	1990
CIP-5407	32nd St. E. - Pond	1990
D140	4th & 66th - Pipeline	2002
D328	1st St. & 65th - Detention Pond	1997
D176	Beach Dr. - Pumpstation	2005
	Browns-Dash Point Basin	
D176	Beach Dr. - Pumpstation	2005

APPENDIX C

PUBLIC INVOLVEMENT –

QUESTIONNAIRE AND RESPONSES

AND

PUBLIC MEETING AGENDA

PIERCE COUNTY WATER PROGRAMS

9850 64th Street West
University Place, WA 98467
(253) 798-2725

NAME
ADDRESS
CITY, WA ZIP

July 2004

Dear Property Owner,

Pierce County is developing a basin plan for areas of unincorporated Pierce County in the Hylebos and Brown's Dash Point Basins, and your input is needed. The County would like to incorporate your concerns about stormwater drainage or water quality problems for a comprehensive picture of stormwater needs in these areas. The Hylebos Creek and Brown's Dash Point Basins are shown on the enclosed maps. Please complete the attached questionnaire and return it to Attn: Hans Hunger, Pierce County Water Programs, 9850 64th Street West, University Place, WA 98467. Responses are requested by July 30, 2004.

Your comments will help the County prioritize stormwater problems in unincorporated areas of these basins. In addition to collecting information from you, the County will also gather and summarize information from the Department of Ecology, Service Response System reports, County staff, and other jurisdictions. All this data will be used to prioritize problems and develop options for improvement projects.

We appreciate your time and input. If you have any questions about this planning effort, please feel free to contact me at (253) 798-2725.

Sincerely,

Hans Hunger

Capital Improvement Program Manager

Hylebos Creek/Brown's Dash Point Basin Plan
Introductory Stakeholder Questionnaire

Please Mail Completed Questionnaire to:
Attn: Hans Hunger,
Pierce County Water Programs,
9850 64th Street West
University Place, WA 98467

(Providing personal information is optional, but helpful)

NAME: Email:

ADDRESS: Phone:

CITY, WA ZIP:

PARCEL #:

How Long Have You Lived In or Been Associated with the Hylebos Creek or Brown's Dash Point Basin?:

What do you see as the most pressing issues in the Hylebos Creek or Brown's Dash Point Basin?:

Please Describe Any ***Specific*** Flooding Problem Areas. You may mark up the enclosed map to illustrate problem location:

Please Describe Any ***Specific*** Water Quality Problem Areas. You may mark up the enclosed map to illustrate problem location:

What Prior Improvements/Policies Have Benefited the Hylebos Creek or Brown's Dash Point drainages?:

Other Comments:

Thanks for your input!!!

Questionnaire Responses

The County had received 19 responses to the mailing by September 9, 2004. Thirteen responses were from property owners in the Browns Dash Point Basin and six were from property owners in the Hylebos Basin. The concerns of the respondents included: erosion, reduced base flows in creeks, filling of wetlands, water quality impacts of impervious areas, flooding, effects of development on salmon, failing septic systems, and invasive species. The responses are summarized below in Table A-1. Where appropriate, the comments column in the table below includes a technical note by the Brown and Caldwell staff regarding relationship of the complaint to problem sites visited with County staff or recommendations for referring the complaint to other appropriate jurisdictions for follow-up activities.

Table A-1 – Summary of Responses from Questionnaires

STREET	CITY	ISSUES	FLOODING	WATER QUALITY	COMMENTS
Browns Dash Point Basin					
5318 Hyada Blvd NE	Tacoma	Street runoff and neighbors runoff collects in yard.	Runoff not collected into storm drain system. Groundwater flooding however has been addressed by County.		**BC Note:** County Roads recently built berm around catch basin. Problem solved?
5446 Hyada Blvd NE	Browns Point			Water filter fills with sediment.	
7506 Eastside Drive NE	Tacoma	Invasive species, recreation access to waterway, development impacts to watershed	Flooding along Rte 509. City of Tacoma culvert and drain on property helps prevent flooding.	Runoff to Caledonia Bay is sudsy, oily	Would like more info on basin plan proposed projects **BC Note**: This property correlates to BDP-3
6109 21st Ave NE	Tacoma	Gravity	Yard gets wet annually.		
2234 Dogwood St NE	Dash Point	Too much runoff going into streams	Annual flooding as result of development of hill above property.	Drinking water quality is still good	County engineer visited in 1980's but nothing happened. **BC Note:** Problem could be related to BDP-2 from Task 4
5700 Overlook Ave NE	Tacoma	Filling of wetland			Destruction of 51st St. wetlands and stream by City of Tacoma flow diversion **BC Note**: refer complainant to City of Tacoma
5323 Varco Road NE	Tacoma			Erosion of ravine slopes	**BC Note:** Appears related to BDP-3

STREET	CITY	ISSUES	FLOODING	WATER QUALITY	COMMENTS
5222 Broadview NE	Tacoma	Erosion control and land slides	Land slides		**BC Note:** Property is outside study area
1517 51st Street NE	Tacoma	None	None	None	None
5115 Varco Road NE	Tacoma	Old septic systems			Save headwater drainage areas
720 Klapache Ave NE	Browns Point	erosion	Flooding in winter		
4764 Hyada Blvd NE	Tacoma	Landslides above Marine View Drive			
5004 Tok-A-Lou Avenue NE	Tacoma	Stormwater collection and abatement/drainage	Insufficient collection drains	None observed	Has built private stormwater system.
Hylebos Basin					
2210 88th Avenue East	Edgewood	Low flows from Surprise Lake outlet		Concerned about erosion of canyon slopes	Concerned about lack of flow in Surprise Lake outlet. **BC Note**: Property is outside study area
605 5th Avenue	Milton	Drainage	**Specific Problem**: Property and house floods 2-3 times/year		City of Milton has said would buy out but is not acting **BC Note:** Property is outside study area
1804 23rd Avenue	Milton	Poor water quality of runoff from impervious areas affects Surprise Lake	SW side of Surprise Lake by the outlet, outlet capacity is regularly exceeded.	Oil, transmission fluid, anti-freeze	**BC Note:** Property is outside study area
7808 Pacific Highway E	Milton	Protection of salmon habitat			Have provided habitat easement to Friends of the Hylebos
7110/7111 Pacific Highway E	Milton	Wants to protect creek for salmon spawning	I-5 lane has flooded in extreme events		
113 57th Ave	Tacoma	Bringing in sewer lines		Houses on Fife Heights affect water quality	Map is wrong- shows streams that are really dozer tracks.

PUBLIC MEETING SUMMARY

Pierce County held two public meetings as part of the development of this Basin Plan. The attached page shows the agenda for those meetings..

HYLEBOS/BROWNS POINT/DASH POINT BASIN PLAN
Two Public Meetings:

Thursday, April 28, 2005	Tuesday, May 3, 2005
7:00 p.m.-9:00 p.m	10:00 a.m.-12:00p.m.
Browns Point Improvement Club	Fife Community Center
201 Ton-a-wan-da Ave. NE	2111 54th Ave. E
Tacoma, WA 98422	Fife, WA 98424

Staff from Pierce County Public Works and Utilities Water Programs Division will discuss surface water management issues in the Hylebos/Browns Point/Dash Point areas. The public is invited to attend either of two upcoming meetings.

Water Programs staff members and their consultant, Brown and Caldwell, will present proposed solutions to surface water management issues that have been identified in these areas of the County. The issues were identified with the assistance of area residents. The presentation is part of the development of a basin plan for these unincorporated areas of Pierce County.

The Basin Plan, which was initiated in 2003, is part of an effort that commenced in 1999 to update the original 1991 Pierce County Storm Drainage and Surface Water Management Plan. The 1991 Plan is being updated with plans for individual basins and groups of basins. Basin Plans like this one provide Water Programs with direction for surface water management activities and a capital improvement program.

If you have questions about the Hylebos/Browns Point/Dash Point Basin Plan please call Ingo Kuchta, Project Manager, at 253 798-6165 or Janine Redmond, Senior Planner, at 253 798-7569.

We thank the Browns Point Improvement Club and the City of Fife for allowing us to use their facilities for these public meetings.

K:\D010 BASIN PLANS\Hylebos\Stakeholders\MEETING NOTICEhy2.doc

APPENDIX D

EXCERPT FROM

PIERCE COUNTY BUILDABLE

LANDS REPORT

SEPTEMBER 2002

Table 6 – Pierce County Urban Development Assumptions and Trends			
	Comprehensive Plan Assumption	**1995-2000 Average**	**Future Assumptions**
Percent of Land Used for: Recreation / Park	20%		Not Applicable
Percent of Land Used for: Public Facilities / Institutions		Not Available	Documented needs
Percent of Land in Residentially Zoned Districts for non-residential uses		MSF: 16%	MSF: 16% HRD, MUD, Centers: 5%
Percent of Land Unavailable for Development	Vacant/Resource Lands: 15% Underdeveloped: 20%	Not Available	Single-Family Districts: vacant, 15% underdeveloped, 20% Multi-Family Districts: vacant, 20% underdeveloped, 40% Commercial: vacant, 10% redevelopable, 50% underdeveloped, 25%
Employees per Gross Acre	Not Applicable	Not Available	Manufacturing/WTCU: 11.2 employees per acre Retail/FIRES: 34.3 employees per acre Government: 22.7 employees per acre Displaced Employees: Commercial, 10 empl./acre Industrial, 4 empl./acre

Table 8 – Pierce County
Supply of Land/Lots for Residential Development

Comprehensive Plan Designation		MSF			HRD			MUD		
Zoning District		MSF			HRD			MUD		
Land Type		Vacant (gross)	Vacant (net) ≤0.50ac	Under-developed	Vacant (gross)	Vacant (net) ≤0.25ac	Under-developed	Vacant (gross)	Vacant (net) ≤0.25ac	Under-developed
Gross Acres[1]		9906.52	695.02	10,025.24	65.65	0.79	102.51	666.68	1.67	189.43
Future Capital Facilities		890.19			5.59			5.59		
Adjusted Gross Acres		9016.33		10,025.24	60.06		102.51	661.09		189.43
Individual Plat Deductions	Roads	1352.45		1503.79	9.01		15.38	99.16		28.41
	Critical Areas	1454.36		1190.11	21.75		6.73	82.32		20.37
	Parks and Open Space	N/A		N/A	N/A		N/A	N/A		N/A
	Stormwater Facilities	N/A		N/A	N/A		N/A	N/A		N/A
Net Acres		6209.52		7331.34	29.30		80.40	479.61		140.65
Non-Residential Uses		993.52		1173.01	1.47		4.02	23.98		7.03
Adjusted Net Acres		5216.00		6158.33	27.83		76.38	455.63		133.62
Land Unavailable for Development		782.40		1231.67	5.57		30.55	91.13		53.45
Final Adjusted Net Acres		4433.60		4926.66	22.26		45.83	364.50		80.17
Total Adjusted Net Acres		9360.26			68.09			444.67		
One potential dwelling unit per vacant (net) lot			3,174			4			11	
One displaced unit per underdeveloped parcel[2]				3,726			22			86

[1] In Mixed Use Districts, gross acres represent only the land assumed for residential uses. See Table 5 "Development Assumptions and Trends"
[2] Displaced units represent a percentage of the gross acres vs. market availability

APPENDIX E

HYDOLOGIC AND HYDRAULIC

CALCULATIONS

Storm drainage problems selected for further analyses were primarily conveyance problems, where existing facilities lacked adequate capacity to pass high flows. To evaluate the adequacy of these systems for current and future runoff flows, the planning team used a hydrologic model to develop design flows for the areas tributary to each problem site. This section briefly summarizes the technical approach used to conduct these analyses. For a more detailed explanation, please refer to the *Pierce County Stormwater Management and Site Development Manual* (Pierce County Stormwater Manual) (1999).

The Santa Barbara Urban Hydrograph (SBUH) method was used with a Type 1A 24-hour storm to determine peak flows associated with the 10-year, 25-year and 100-year storms. Specific storm precipitation volumes obtained from the *Pierce County Stormwater Manual* are shown in Table E-1 below.

Table E-1. 24 Hour Precipitation Values

Storm Event	Precipitation, inches
10-year	3.0
25-year	3.5
100-year	4.2

Additional input for the SBUH method included sub-basin size (i.e., drainage area tributary to the problem site), runoff curve numbers, hydraulic length, and average land slope. The size of each sub-basin was determined using United States Geological Survey (USGS) maps, County aerial orthophoto images, 2-foot contour lines and the existing storm drains. A planimeter was used to calculate the area of each sub-basin. The County was contacted when topographic data and site observations conflicted with GIS data on existing storm drain facilities. Additional site visits were also conducted to clarify details and address questions raised by the County staff.

Runoff curve numbers were based on land use and soil types. Existing .and use was determined by reviewing orthophotos and estimating the number of houses per acre or the percentage of trees and road within a sub-basin. Based on conversation with County staff and review of maps of tributary areas, most of the problem sites in the Browns-Dash Point Basin are downstream of areas that are already largely built out; hence, for these areas future land use was considered to be equivalent to existing land use. In the Hylebos Basin, zoning was used to represent future land use, since greater additional upstream development is expected in the Fife Heights area.

Soil types for the sites were determined from soil classification information available from the Natural Resource Conservation Service (previously Soil Conversation Service (SCS)) website. Soils information was cross-referenced with the Hydrologic Soil Groups in Appendix E of the *Pierce County Stormwater Manual*. The soils in these basins were primarily Type C, which is classified as having "moderately high runoff potential." One sub-basin had some Type D soil which is classified as having "high runoff potential." These parameters were then input into the hydrologic model look-up table to obtain curve numbers for the various sub-basins.

Sub-basin size, SCS soil type, acres/house, hydraulic length, and average land slope were input into HydroCAD models to calculate peak flows for each of the sites. Table 6-2 lists the results of the peak flow calculations.

Table E-2. Peak Flow Calculations

Site	Subbasin	Existing Peak Flow (cfs)			Future Peak Flow (cfs)		
		10-year	25-year	100-year	10-year	25-year	100-year
BDP-2	A	3.09	4.31	6.14			
	B	0.16	0.21	0.29			
	C	0.07	0.09	0.14			
BDP-3	A	5.07	6.53	8.62			
	B	1.45	2.00	2.83			
	C	1.47	2.04	2.90			
	D	29.74	41.74	59.90			
	E	17.80	24.82	35.36			
BDP-6	A	1.64	2.18	2.97			
	B	0.15	0.19	0.25			
BDP-7	A	5.31	6.89	9.17			
	B	0.79	1.02	1.34			
	C	0.36	0.47	0.62			
	D	0.80	1.04	1.37			
BDP-7a	A	1.22	1.49	1.88			
	B	0.13	0.17	0.22			
	C	0.85	1.04	1.31			
BDP-8	A	0.50	0.75	1.12			
	B	0.37	0.49	0.67			
H-1	A	0.66	0.91	1.30	0.84	1.13	1.55
	B	0.15	0.18	0.23	0.16	0.19	0.24
	C	4.19	5.83	8.29	5.35	7.16	9.83
H-2	A	0.71	0.97	1.36	0.82	1.10	1.50
	B	0.49	0.65	0.89	0.49	0.65	0.89
	C	1.37	1.91	2.73	1.76	2.36	3.25
	D	6.23	9.13	13.60	10.72	14.37	19.78
	E	0.56	0.68	0.86	0.56	0.68	0.86

After flows tributary to each problem site had been calculated, the hydraulic model Full EQuations (FEQ) was used to simulate current physical conditions. FEQ simulates flow by solving the full, dynamic equations of motion for one-dimensional unsteady flow in open channels and through control structures. The model may also be run in steady state mode. After existing hydraulic conditions were represented in FEQ, potential solutions were modeled to identify measures that would meet required levels of control as specified in the *Pierce County Stormwater Manual*. Details of the improvements and associated estimated construction costs are presented in Chapter 7 and Appendix F.

APPENDIX F

PRIORITIZATION AND COST ESTIMATES FOR

RECOMMENDED CAPITAL PROJECTS

This appendix documents the County's prioritization system and its application to each recommended projects. It also includes cost estimates for all the projects.

In general, each recommendation is assigned a project number that represents the following:

- **Project Category:** Either PRG (Programmatic), CIP (Capital Improvement Project), or ST (Study).
- **Basin:** Basin number 1 for Browns Dash Point and 4 for Hylebos.
- **Sub-Basin:** BDP for Browns Dash Point, WH for West Fork of Hylebos Creek, EH for East Fork of Hylebos Creek, LH for Lower Hylebos Creek and SL for Surprise Lake.
- **Project Type:** CP for culvert and pipe, CR for culvert replacement, MNT for maintenance, OUT for outfall, and SBS for streambank/channel stabilization.
- **Project Order Number:** Number starting with 01 for each project type in each sub-basin.

PRIORITIZATION FOR RECOMMENDED CAPITAL PROJECTS

Projects were assigned scores based on four categories of benefits: flood reduction, water quality improvement, natural resource improvement & protection, and other factors.

1) FLOOD REDUCTION

Existing Conditions - Full points can be added to each applicable category.

a) Level of Flooding (check all that apply)
   1) Prevents inconvenience flooding – yards, driveways, minor streets where alternate route is readily available)
   2) Prevents hazard to public safety – This represents closure to arterial road, closure of road where no alternative access is readily available, risk of bridge damage, or flooding that will greatly exacerbate a water quality problem.
   3) Prevents risk to critical facilities – Critical facilities as defined in County Code include medical facilities, schools (including day-care structures), structures housing toxic or explosive substances, and structures with occupancy of greater than 5,000 people. This will also include sewer pump stations and water supply facilities.
   4) Prevents severe property damage (>$100,000/year)
   5) Prevents minor property damage (<$100,000/year)

b) Frequency of flood prevention (score one)
   1) Prevents annual flooding

2) Prevents flooding every 1 to 5 years
3) Prevents flooding every 5 to 25 years
4) Prevents flooding less that one in 25 years

c) Required Due to Flooding Liability – CIP is required by lawsuit, settlement, policy, code, or executive order.
d) Increases capacity of flood plain.
e) Correct Non-compliance with County Design Standard – To be applied when problems are related to public infrastructure such as culverts and ponds that do not conform to current County design standards.

Future Flood Hazard – This category recognizes that even under current regulations new developments have negative impacts on flooding and water quality by increasing the volume of runoff coming from a site and also the amount of pollutants which might not be captured in constructed water quality facilities. Within areas that are slated for growth under the Pierce County Comprehensive Plan it can be estimated that amount of change in these factors. As areas develop project costs such as land acquisition become increasingly expensive and therefore opportunities should be taken advantage of as early as possible to foresee future problems and build or preserve facilities. Scoring for this category should be based on the level of change an area is slated for and the protection that is deemed necessary for downstream environment.

f) Level of increase in flooding (peak rate or volume) or water quality problems that are anticipated due to landuse changes within the area of the problem. (score one)
   1) High
   2) Medium
   3) Low
g) Estimated opportunity to doing the project now in feasibility and cost benefit verses waiting and doing project later. (score one)
   1) High
   2) Medium
   3) Low

2) WATER QUALITY IMPROVEMENT

Although water quality improvements are often closely tied with decreased levels of flow, which were addressed in section 1, this section addresses individual water quality impacts and potential improvement. Each category should receive points if the project provides the benefits of that particular category.

a) Reduce sources of or Impacts from emission of fine sediments- Levels of fine sediments tend to increase as an area urbanizes. The most common source is construction sites where soils are disturbed and inadequate source controls are applied. Other sources include logging operations, dirt tracked onto roads from equipment and vehicles, pressure washing of buildings and vehicles, and sand applied to icy roads. Scoring in this category is based on the ability of the project to capture entrained sediment, or prevent sediment from entering system, or reducing scouring. Decreased or negative points could occur if the project had a

high potential of causing increased levels of sediment from the project site, or tended to pass through sediments from upstream.

b) Reduce sources of or impacts from emission of heavy metals – Metals are utilized in many products important to our daily lives. Certain metals, known as heavy metals, wear off of our car brakes and tires, and come from the paint and moss-killing roof strips and herbicides we use at our homes. These metals can cause severe health and reproductive problems in fish and animals that live in water and sediments that become contaminated by runoff. Because many heavy metals adhere to sediment the water quality facilities designed to capture sediments will also capture sediments.

c) Reduce sources of or impacts from emission of excess nutrients – In the context of water quality, nutrients are mainly compounds of nitrogen and phosphorus. When nutrients are allowed to enter waterbodies, undesirable effects such as algae overgrowth, oxygen depletion, channel clogging due to overgrowth of vegetation, and fish and animal death can occur. Sources of nutrients can include fertilizers, failing septic systems, and yard and animal wastes.

d) Reduce sources of or impacts from emission of oxygen demand – Degradable organic matter, such as yard, food and pet wastes, and some chemical wastes, can have a drastic effect on water quality if they are allowed to enter stormwater. As bacteria break down these substances, the oxygen in the water is consumed. This stresses and can eventually kill fish and other creatures in the water.

e) Reduce sources of or impacts emission of oil and grease – Oils and greases can be either petroleum based or food-related sources. Petroleum-based compounds can be immediately toxic to fish and wildlife, and if they reach our drinking water aquifers, will make us sick too. Food-based oils and greases may not be toxic to us, but they can coat fish gills and insects, and suffocate them.
Impervious surfaces within an urban area generate oil and grease from the uses surrounding that surface such as vehicles that use it. Because the impervious surface has no way to capture the oil and grease it is carried downstream with the runoff. There are both mechanical means such as oil/water separators and biological means such as bio-swales and wet ponds to remove the oil and grease from the runoff. Scoring for this category should be based on the effectiveness of the project to remove the pollutants.

f) Reduces sources of or emissions of pathogens such as fecal coliform. – Pathogens such as fecal chloroform are found in urbanizing areas as a result of animal waste, illicit hookup to the storm drainage system, and failing septic systems. Score in this category should be based on the project's ability to reduce the level of pathogens in the system by either correcting the cause or capturing and removing them form the water train.

g) Lowers water temperature/ provides more shade – Scoring for this category should be given if the project will lower temperature in the long term. (So consideration is given after landscaping matures)

3 NATURAL RESOURCE IMPROVEMENT & PROTECTION

a) Improves and/or protects habitat for aquatic species – Many factors affect habitat for aquatic species and are described below. To evaluate the score in this category for each project consider whether the project will improve or protect the following key aquatic-habitat features. In some instances a project may have an unintended consequence of degrading a factor, such as the tendency of some detention ponds to increase water temperature. This degrading factor should be weighed against improvement in other habitat features for whether a score is given in this category.

- ***Riparian Condition.*** Riparian vegetation influences salmon habitat by providing a buffer from upslope activities that can reduce inputs of nutrients and sediments. Riparian vegetation also connects terrestrial and aquatic communities, stabilizes streambanks, and provides vegetative litter and nutrients to the aquatic food web.
- ***Substrate composition and Embeddedness.*** The surface substrate composition is intended to provide an indication of the habitat quality for salmon spawning. Embeddedness represents the percent that interstitial spaces are filled with small grain particles and is used as a measure of fine sediment concentrations in the substrate (May et al. 1997). Embeddedness can affect salmon incubation, emergence, and rearing, as well as benthic biota by decreasing dissolved oxygen concentrations and the available living space
- ***Passage barriers.*** Accessibility to habitat for spawning and rearing is assessed based on the physical conditions that limit access to habitat (WDFW 1999), which would otherwise be used based on channel type and location within the stream network. Barriers include physical constraints such as culverts, velocity, flow, and also could include water quality barriers.
- ***Pool frequency.*** Pool frequency is assessed by the number of pools within a reach. Pools can be encountered on the main channel and on side channels of a stream. Pools provide habitat for juvenile salmon particularly over-wintering habitat.
- ***Large woody debris –*** Large woody debris (LWD) is a ubiquitous component in streams of the Pacific Northwest. LWD performs critical functions in forested lowland streams, including dissipation of flow energy, streambank protection, streambed stabilization, sediment storage, and providing instream cover and habitat diversity.
- ***Water Temperature -*** The primary means nature uses to keep the water in streams cooled is through the vegetative canopy to shade the water. Also when movement of runoff is by shallow groundwater the water is protected from the warming effects of the sun. When areas are urbanized the effects of clearing vegetation and reducing runoff from becoming groundwater by creating impervious areas has a warming effect on waterbodies. Scoring in this category should be based on the project's ability to restore some of the natural systems to cool the waterbodies.

b) Improves and/or protects habitat for terrestrial species - Habitat for terrestrial species could include wetlands, forested areas, or prairie land. Scoring for Improvements could be partial for preservation, especially when existing regulations do not offer necessary protection of habitat.

Increased score would be given for enhancement of existing native features or improvement of hydrology.

c) Increase proportion of native plants – Scores for this category recognize the added benefits native species offer to habitat. The score given in this category should be proportional to the effort given increasing the percentage of native plants on a site. Preservation of native plants should not be included in this category because it is specifically looking at improvement in the native plant population.

d) Improves flow regime – Flow regime refers to the rate and volume of runoff from a site. In a natural system much of the rainfall was intercepted in the canopy of the forest and native vegetation or was retained on a sight in small natural depressions. In addition the soil cover that had accumulated over the years had the ability to act like a sponge and retain water to be used by the vegetation and evaporated over time. As land is developed many of these natural functions are interrupted by vegetation being removed, grading smoothing out natural depressions, impervious surfaces covering large quantities of a site, and connecting drainage courses with ditch systems and pipes. This alters the flow regime by producing increased number of peak flow events downstream along with increased volume of runoff from a site. Also shallow groundwater flow is reduced which decreases the base flow of streams during the summer.

Scoring on this category should be base on how much the project restores features of the natural flow regime.

e) Increases channel stability/reduces excess erosion - Bank erosion is a natural process. The location and extent of eroding banks varies naturally according to channel type and under natural conditions is an important process that helps maintain areas of spawning gravel. However, streambank erosion is also typically increased beyond natural levels in urbanized areas. Indicators of bank instability include active erosion (exposed soil and sideslope failures) and artificial streambank protection (levees and riprap). There are a variety of ways to increase channel stability and some may be more favorable then others. Perennial vegetation growing along the bankfull width can provide bank protection and increase bank stability and may be one of the more preferred methods. Armoring a bank with riprap or some other source of protection may stabilize a slope but may score lower because it is not in line with natural methods and usually doesn't solve the source of the problem.

f) Increase the extent of salmonid spawning habitat – Although points have already been given for improvement of habitat for aquatic species this category specifically reflects the opening up of previously closed habitat through the removal of a blockage. The scoring on this category will be based on the following equation
(Q= [Good (ft) * 0.75*Fair (ft)]/ [Total (ft)]

- Good and Fair habitat locations are identified using the Tri-County Urban Stream Baseline Evaluation Method.

- The Length of Good and Fair habitat refers to length of each type habitat upstream of the project until the next upstream barrier.
- Total length refers to the total length of the stream from the project to the next upstream barrier.

Note: Projects should mention in their description whether there are any barriers downstream of the project that should be improved first.

i) Salmonids other than cutthroat trout present - indicates the presence of less common and/or endangered or threatened salmonids in the project area.

4. OTHER FACTORS

a) Provides recreational or multiple use opportunities –

b) Enhances visual aesthetics of area.

c) Provides public educational opportunities

d) Is a highly visible project or has been on the CIP needs list multiple years but hasn't ever ranked high enough to put on the priority list.

The worksheets that follow document the project's or program's potential for flood reduction, improvement of water quality, aquatic habitat protection, and other benefits using approximately 40 criteria. Table F-1 shows the resulting score for each project or program. The top 25% of the projects were designated high-priority, 50% become medium-priority, and the remaining 25% are assigned low-priority.

Table F-1
Project Prioritization Scores

Project Number	Project Name	Rating Score
CIP01-BDP1-CP01	Spring Street NE - Install Drainage Pipe to Reduce Erosion	211
CIP01-BDP4-CP01	Dry Gulch and Varco Rd - Increase Storm Drain Capacity	215
CIP01-BDP5-CP01	Hyada Blvd at Wan-I-Da Ave. and La Hal Da Ave NE – Replace culvert and pipe	164
CIP01-BDP6-CP01	Wa-Tau-Ga Avenue Cul-de-Sac - Storm Drain Replacement	181
CIP01-BDP6-CP02	Layman Terrace - Culvert and Storm Drain Replacement	80

Table F-1
Project Prioritization Scores

Project Number	Project Name	Rating Score
CIP01-BDP6-MNT01	Tok-A-Lou Avenue near Ton-A-Wan-Da Avenue - Replace outfall	126
CIP01-BDP6-OUT01	Catch Basin at Tok-A-Lou Avenue	186
CIP01-BDP8-CP01	Northwood Avenue NE - Trash Racks for System Maintenance	82
CIP04-LH1-CP01	66th Avenue and 8th St - Storm Drain Replacement	171
CIP04-LH1-RST01	Hylebos Creek Restoration	287
CIP04-WH1-CP02	66th Avenue near 1st Street Ct - New Storm Drain	202
PRG01-01	Coordinate with Tacoma-Pierce County Health Department to Prioritize Septic System Inspections	180
PRG01-02	Check for Cross-Connections when Constructing New Drainage Projects in Browns-Dash Point Basin	226

COST ESTIMATES FOR RECOMMENDED CAPITAL PROJECTS

This appendix also contains cost estimates and project descriptions for the recommended capital improvement projects. The cost estimates were prepared from conceptual designs using unit costs and template spreadsheets provided by the County that are based on 2003 costs. These costs should be adjusted as needed for inflation from that date to the expected year of construction.

Some unit costs were modified to address site-specific conditions such as limited access or special construction requirements. A number of new unit items, such as catch basins, inlet structures, and restoration of adjacent improvements, were added to the templates to reflect other site-specific issues that could impact the costs. Additional worksheets are provided showing the basis for the channel armoring and temporary access road construction unit prices. These prices were developed because the cost estimate template provided by the County did not include those items.

The templates provide an estimate for the cost of drainage easements for work on private property (outside the right of way). Although some of the sites may have easements in-place, it

was assumed that new easements must be acquired for the work and maintenance access. The cost for the easements were set at $1.50 per square foot.

Engineering and administrative costs were based on the schedule provided in the CIP worksheet templates. Engineering design and administration costs were typically 20 percent of the estimated construction cost. However, the engineering and administrative costs were adjusted to as high as 50 percent of the construction cost for the projects that were considered more complicated due to coordination with property improvements, and environmental and permitting constraints. Typically a contingency factor of 20 percent was used for the estimates. However, for more complicated projects, the contingency was increased to 35 percent.

The contingency factor is included to allow for higher costs due to changes in scope as the project is designed, changes in quantities, and unforeseen conditions such as relocation of existing utilities or poor soils. Other costs included in the contingency include the additional costs for special handling and disposal of excavated materials with elevated levels of arsenic or other heavy metals. Although the published data suggests that some of the sites may be contaminated, there is not enough information to identify specific contaminant levels and the associated costs for mitigation and clean-up.